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The Rock Products Industry in the St. Louis District

By Earl C. Harsh
Associate Editor, Rock Products

ALTHOUGH underlaid by a 250-ft. deposit of limestone, near the surface and readily obtainable, and with a number of quarries in the city and surrounding territory, most of the aggregate used for concrete work in the city of St. Louis is gravel.

This situation came about as the result of a number of things. The quarries were small and not co-operative and were engaged primarily in the production of rubble stone and hence did not push the sale of stone for this purpose; abundant sand and gravel deposits in the Meramec river district southwest of the city offered plenty of this material at lower production costs; a favorable freight rate from this district permitted shipping by rail to conveniently located retail yards; and quite a considerable part of the gravel production was controlled by the portland cement manufacturers who thus naturally favored and promoted its use in connection with their cement.

Sand and Gravel

Due to mergers and rearrangements made about two years ago, most of the gravel production is now in the hands of three companies. The Standard Building Materials Co., 722 Chestnut street, St. Louis, Conrad G. Besch, president, was a consolidation of the sand and gravel department of the Missouri Portland Cement Co., the Mississippi River Sand and Material Co. and the St. Charles Sand Co., and is understood to handle a little more than one-half of the total gravel in the district.

The Central Building Materials Co. was a consolidation of the Alpha Sand Co., the sand and gravel department of the Alpha Portland Cement Co., the Gravois Material and Supply Co., the Meramec Portland Cement and Material Co. and the Ruprecht Sand and Material Co. George Raterman is president and William Ruprecht, vice-president, and the general offices are at 915 Olive street. It is understood that this company handles about 10% of the total.

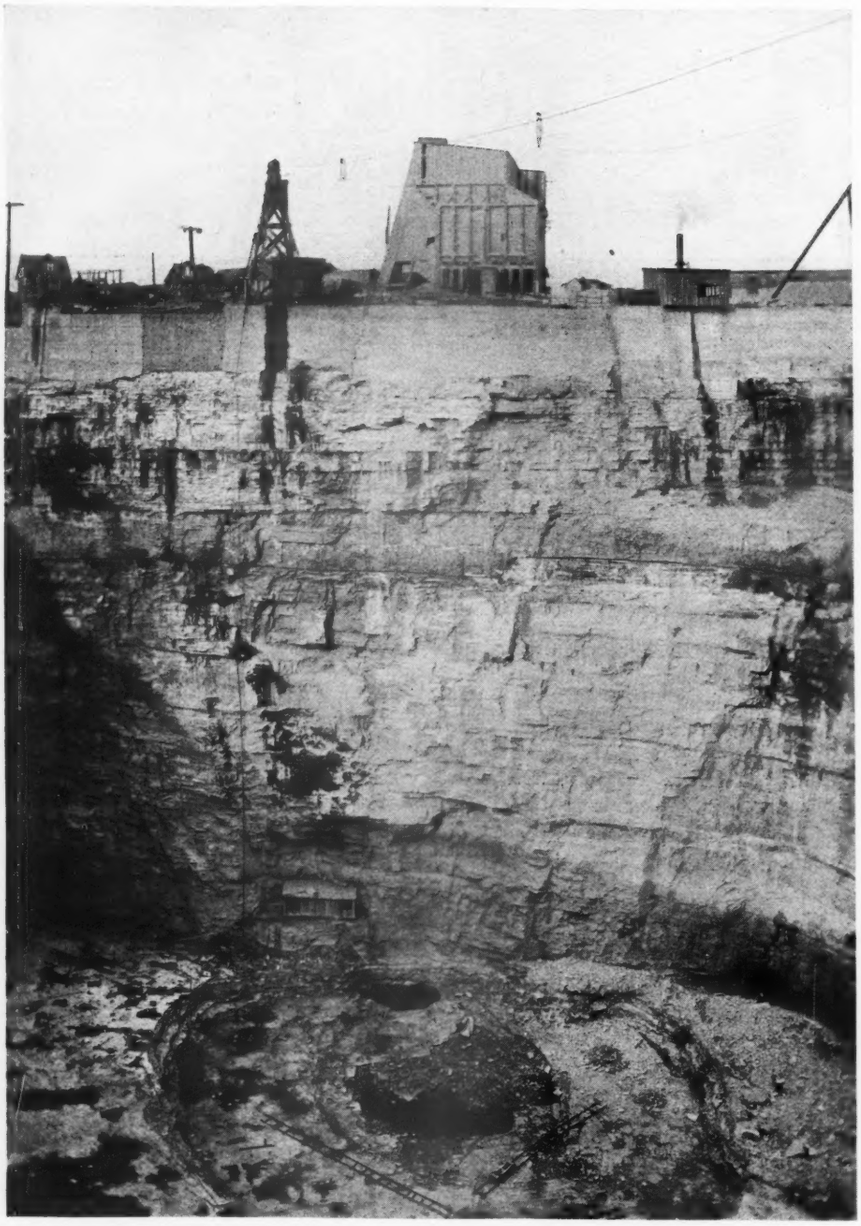
The St. Louis Material and Supply Co., 314 North Fourth street, Edwin H. Conrades, president, and Otto S. Conrades, vice-president and general manager, have been operating two plants, one at Moselle and one at Pacific, Mo., for a number of years and are understood to produce around 20% of the total in the district. The balance comes from a number of smaller producers in the Meramec river district.

All of these plants are being operated at reduced capacities (written in December, 1930) around 50 to 60%, because of the lessened activity in building operations. No very radical changes in operating methods have been made in recent years, although probably more improvements in the interests of efficient and economical operation will be made in the near future.

Standardized Sizes of Coarse Aggregates

One matter of considerable interest and importance is the recent simplifying and co-ordinating of the coarse aggregate specifications to reduce the number of different sizes and properties called for in different parts of the district. The new specifications apply to both gravel and crushed stone and reduce the grading requirements to three sizes for the various kinds of concrete work, one size for road and street paving, one for reinforced-concrete work of large mesh and one for reinforced-concrete work of small mesh. This was worked out by the St. Louis branch of the National Sand and Gravel Association, the St. Louis Quarrymen's Association and the various municipal and other engineers interested, and has been quite generally adopted.

One of the Eyermann quarries



Quarry and crushing plant of Tower Grove Quarry and Construction Co.

Also of importance in connection with the marketing of gravel and crushed stone in the district is the rapidly increasing use of ready-mixed concrete. The General Material Co. with five plants for the production of ready-mixed concrete, whose operation is described elsewhere in this issue, has built up this branch of the construction industry to a point where some 200,000 tons of aggregates are used annually in this way.

Crushed Stone

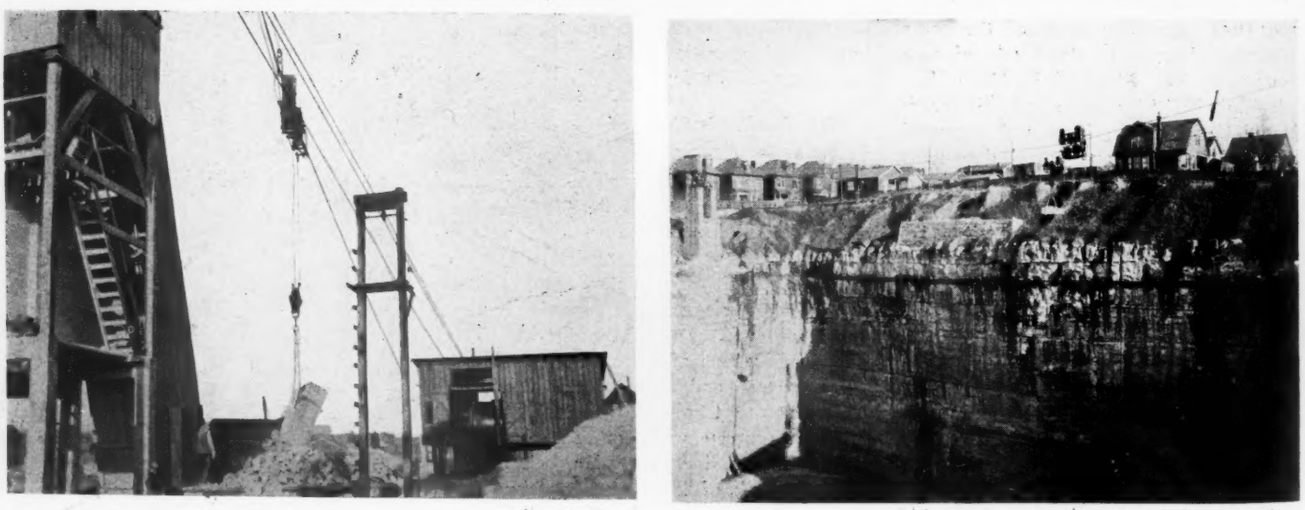
The crushed stone used in the district is supplied both by outside quarries across the river in Illinois and also by more than a dozen smaller quarries within the district itself. In the case of the former, the stone is for the most part shipped in by rail to distributing yards, which procedure is no doubt economic by reason of the lower unit production costs of the larger operations. The quarries within the city of course deliver by truck to the work.

Columbia Quarry Co.

The Columbia Quarry Co., with offices in the Syndicate Trust building, St. Louis, has two plants across the river, one at Valmeyer, Ill., and one near Columbia, Ill., and is the largest producer in the district. The Columbia operation was described in Rock Products, August 8, 1925, and September 1, 1928, and the Valmeyer plant in Rock Products, January 5, 1929. These plants are south and east of St. Louis about 15 miles and 25 miles, respectively.

During the past year the company built a new distributing yard (known as Yard No. 1) in East St. Louis at Eighth street and the Illinois Central Railway near the east end of the municipal bridge and convenient to downtown St. Louis. This was completed in February, 1930, and consists of a neat, compact installation of truck loading bins of 600 tons capacity, 80 ft. long, with compartments for six different sizes in all.

Stone from the crushing plants, arriving by rail in hopper bottom cars, is fed from a track hopper to an inclined belt conveyor



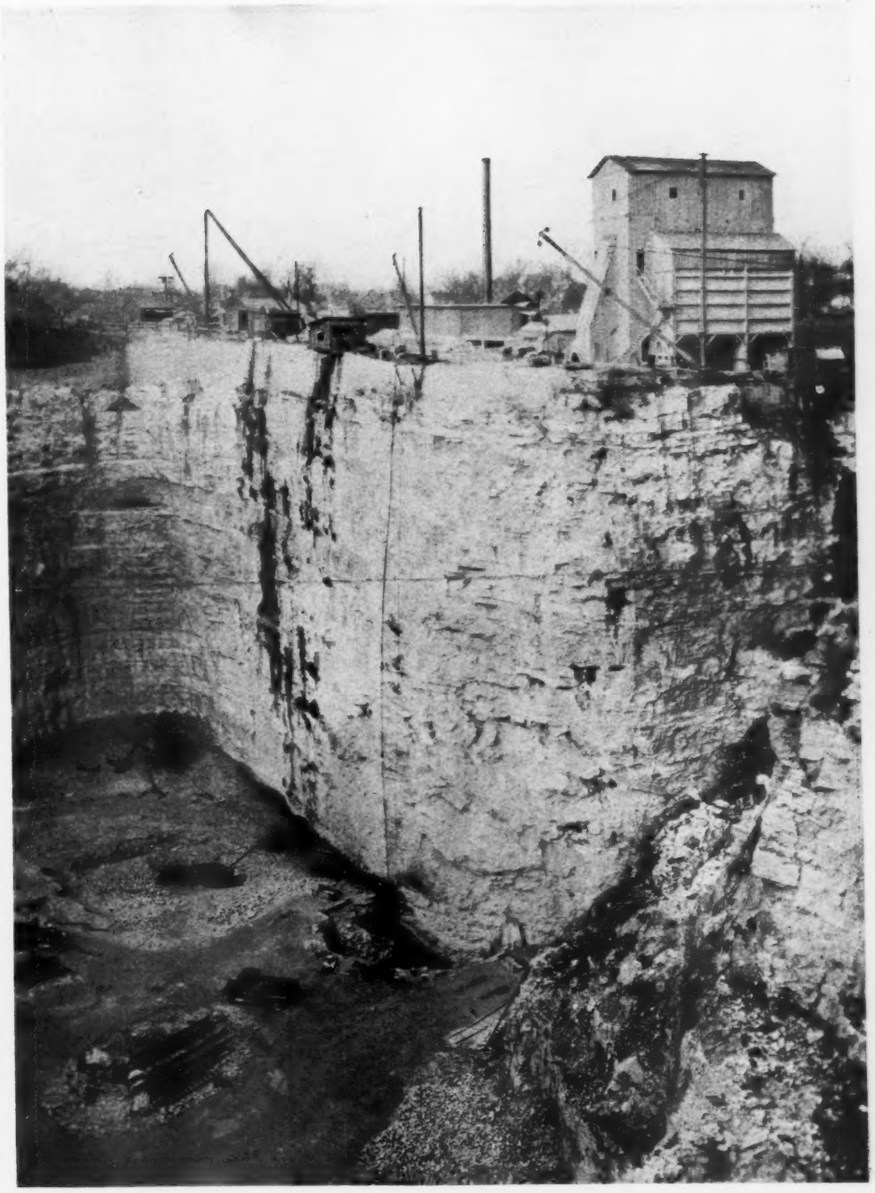
Union Quarry and Construction Co.; at left, dumping skips to crusher; and at right, view looking across quarry

24 in. wide by 250 ft. long, housed in a steel frame gallery with galvanized corrugated iron covering. From this belt the material is distributed to any bin by means of a 24-in. shuttle belt conveyor traveling on a track above the bins. The conveying equipment was furnished by Stephens-Adamson Manufacturing Co. and is driven by individual motors. A neat attractive office of stone construction adjoins the bins. Trucks are weighed on a 15-ton Howe platform scale with weightograph attachment.

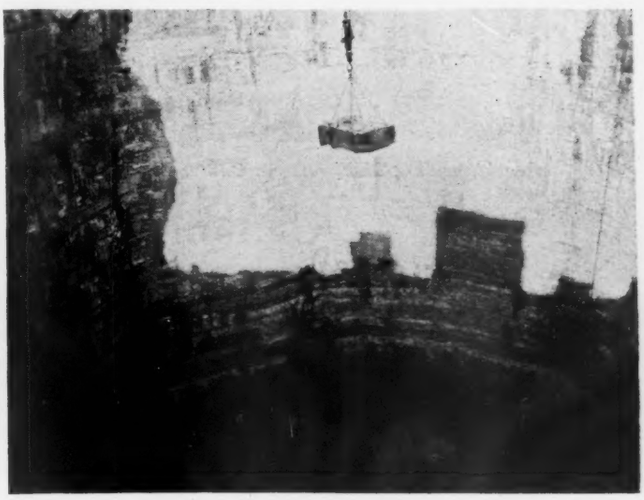
Also at the west end of the McKinley bridge and serving the north side, this company has a set of nine reinforced concrete truck loading bins which are operated in conjunction with the retailing and trucking facilities of the Hunkins-Willis Lime and Cement Co. These bins are ideally situated, adjoining the Illinois Terminal Traction System, which comes in over the bridge, so that the cars containing stone are switched out over the bins and emptied into them.

At Valmeyer the company has very recently (November, 1930) put into operation a new fine grinding plant for the production of pulverized limestone for mine dusting, asphalt filler, etc. The material has a fineness of 87% through 200-mesh and 97% through 100-mesh, and is shipped either in bulk or jute bags or in 100-lb. paper sacks.

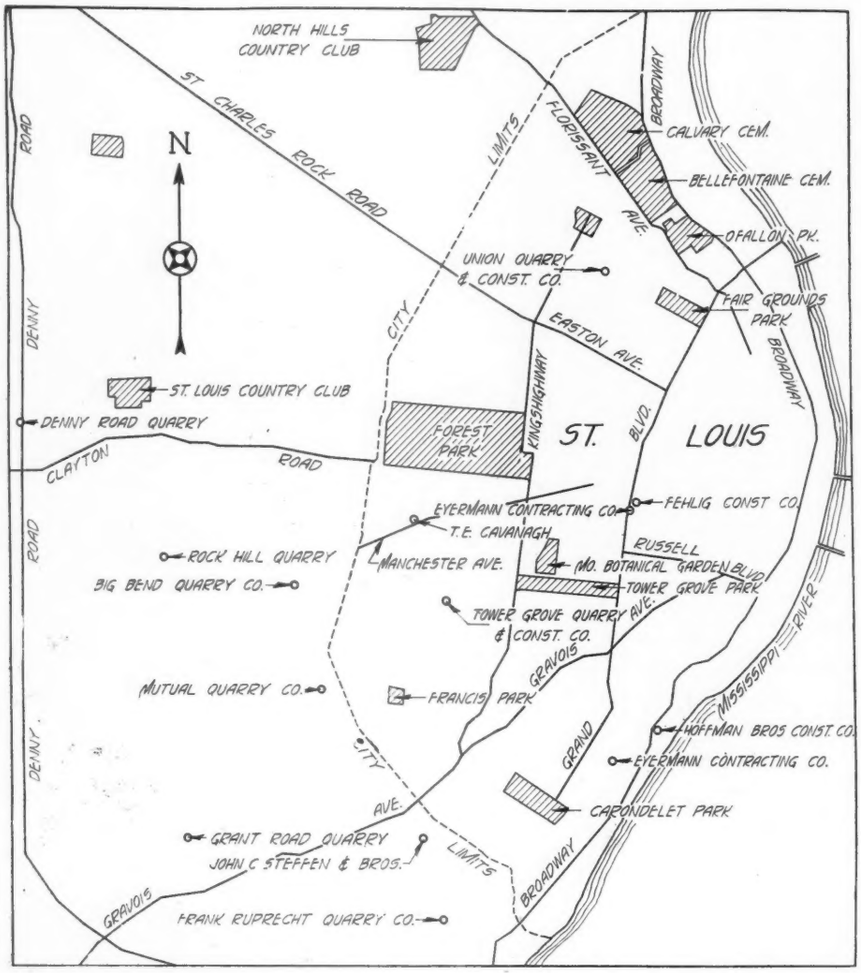
The smaller sizes from the crushing plant are carried over the railway loading tracks by belt conveyor to a bin at the fine grinding plant, where the material is fed to a Raymond 5-roll, high-side mill. There it is dried during grinding by heat from a small coke-fired boiler. Above the mill a Raymond fan lifts the fine material from the separator on top of the mill to a cyclone collector above, from which it is carried over by a short screw conveyor to a 200-ton storage bin. Below the bin is a 2-tube Bates packer driven by a 3-hp. G.E. motor, for packing the material in valve bags, and spouts for bulk handling. The plant has a capacity of about 30 tons per day. Both the Raymond mill and fan are driven by 50-hp. motors through Texrope drives.



Quarry and crushing plant of the Big Bend Quarry Co.



The quarry floor of the Union Quarry and Construction Co. is 250 ft. below ground level



Above is a map of the St. Louis metropolitan district showing location of the various aggregate producing plants

Crushing plant of Eyermann Contracting Co.

Crusher house and cableway at Tower Grove plant

Illinois Electric Limestone Co.

The Illinois Electric Limestone Co., with a plant at Falling Springs, Ill., is the second largest producer in the district. This operation, formerly the East St. Louis Stone Co., was taken over by the present owners in 1927 and a new crushing plant completed early the following year.

The new plant and the whole operation were fully described in Rock Products, September 15, 1928, with no important changes in methods since then. The offices of the company are at 818 Olive street, St. Louis. John D. Moore is president.

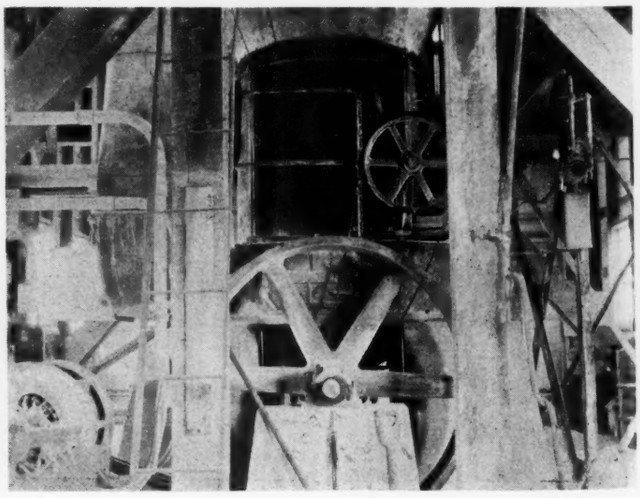
Casper Stolle Quarry and Contracting Co.

The other producer, located on the east side of the river, is the Casper Stolle Quarry Co. with plants at Stolle and Falling Springs, Ill., adjoining the Illinois Electric Limestone operations. The plant at Stolle is perhaps the oldest in the district, as the first crusher, a No. 3 Gates, was installed in 1882. The plants have been rebuilt a number of times and were described in Rock Products, September 1, 1928, since which date no radical changes have been made. The offices of the company are in the First National Bank building, East St. Louis. F. W. Stolle is president and general manager.

Quarries Within the Metropolitan District

St. Louis and St. Louis county are unusually well supplied with limestone quarries, a half dozen being operated within the city itself and as many more in the immediately adjoining territory to the west and south.

Most of these have been worked for a great many years, more as a side issue in connection with contracting work and the getting out of rubble stone than for the sale of crushed and sized stone, which has thus been more or less a secondary matter. With so many independent producers serving the district there has naturally been considerable competition, with some price cutting,



Roller mill at Valmeyer plant of Columbia Quarry Co.

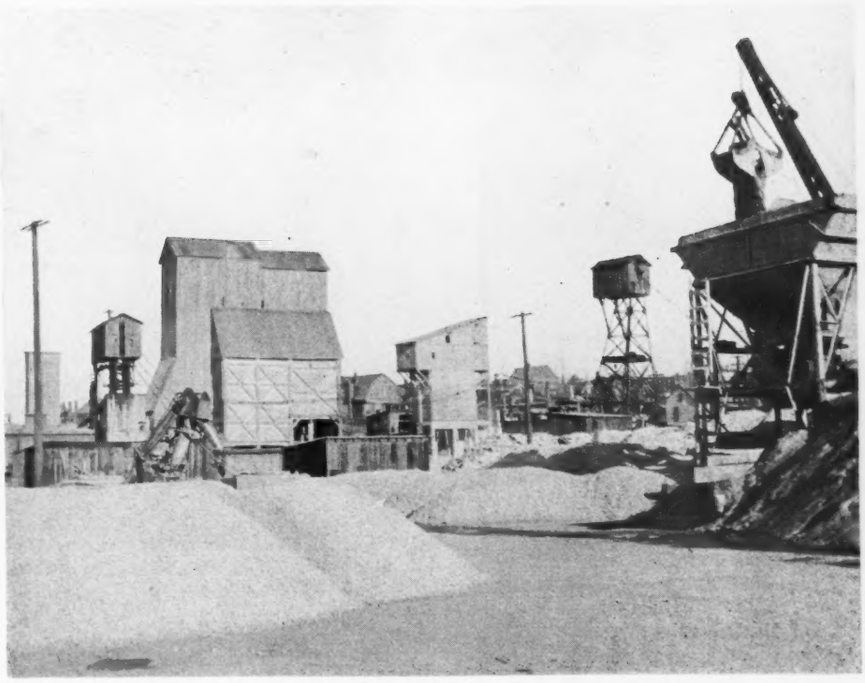
particularly under present conditions of lessened demand.

These quarries are practically all owned and operated by contractors who use them primarily to get out stone for their own work, either rubble stone or crushed stone for paving or general building construction. Most of them are comparatively small in area, perhaps four or five acres or a city block in extent and about 150 ft. deep, although one, which has been worked for 44 years, is 250 ft. deep. They are for the most part located in built-up sections with residence or business property all around, so that they are necessarily restricted in their mode of operation.

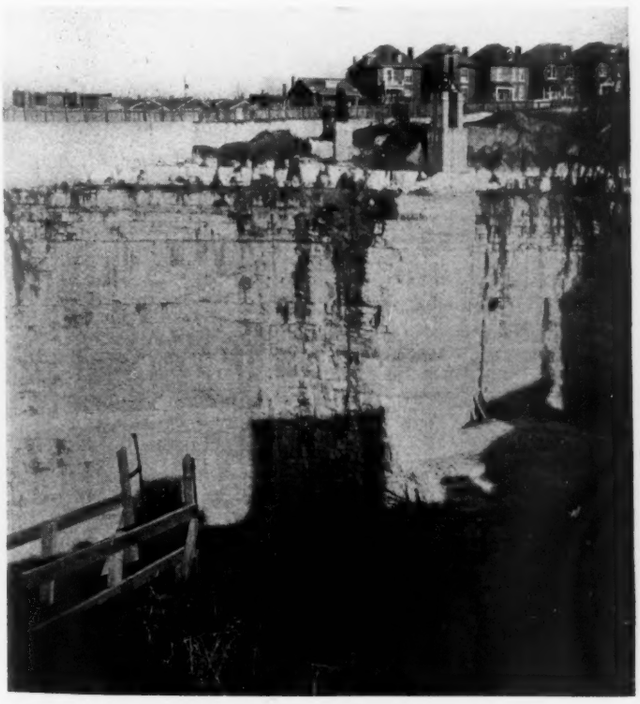
Quarrying is done by air drilling and blasting in the usual way, working rather shallow ledges, and loading the stone into skips either by hand or by a small shovel and dump trucks. Like the mules in some deep mining operations, such equipment after once being put down into the quarry stays there. The skips, holding about 3 tons of stone, are brought to the surface and moved to the primary crusher by a cableway which spans the quarry hole. These crushers, are usually No. 4, 5 or 6 gyratories, and the rest of the crushing plant consists of a bucket elevator and revolving screen, with sometimes a recrusher and a vibrating screen for handling the smaller sizes. Hammer mills are used at some plants for producing agricultural limestone and in connection with dust collectors some pulverized limestone for asphalt filler is produced.

These plants have capacities ranging from about 100 tons per day up to 500 tons per day (with the exception of a larger operation of the open quarry type). Although it might ordinarily be expected that quarries of this depth would require considerable pumping to keep them free of water, such is not the case here, as the water is removed from small sump holes with pumps of moderate size operating only part of the time.

The St. Louis district is unique in having a local association of stone producers, the St. Louis Quarrymen's Association, which, under the direction of Col. E. J. McMahon, executive secretary, has accomplished a great deal in



Crusher house and handling equipment of Union Quarry and Construction Co.



Another view of the Union quarry

Quarry of Frank Ruprecht Quarry Co.

Crushing plant of Rock Hill Quarries Co.

the way of co-operation among the producers and in making larger markets for stone.

An interesting feature about those quarries within the city is that unlike most quarries elsewhere they have a certain value after they have been worked out. This is because they offer a convenient place to dump refuse, which otherwise would have to be hauled some distance. Thus at a nominal charge per load dumped the worked-out quarry affords some revenue until filled up, when of course the site becomes much more valuable.

Rock Hill Quarries Co.

Of these quarries the largest producer is the Rock Hill Quarries Co., H. E. Billman, president, with offices in the Title Guarantee building, St. Louis, and operating three plants known as Rock Hill, Denny Road and Grant Road, all west and southwest of the city limits. Also this is the only one of these operations carried on by the more usual quarrying method of spreading out instead of going down.

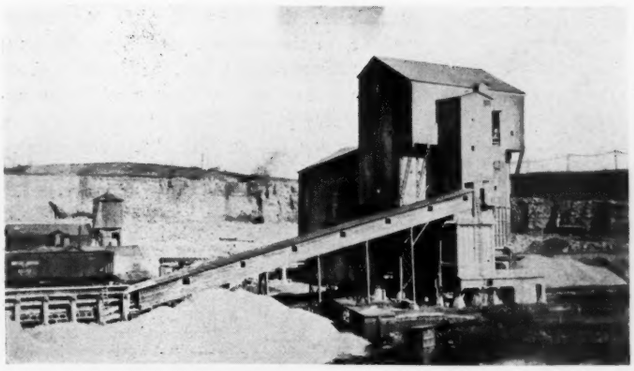
The Rock Hill operation, the largest of these three, has a capacity of about 800 to 1000 tons per day. It is located on North Rock Hill road, about one-half mile north of Manchester road and three miles west of the city limits, with rail connection to the Creve Coeur branch of the Missouri Pacific Railway. Only a small amount, however, is shipped by rail, most of the output being trucked for road construction. The property is rather hilly and the face being worked ranges from 25 to 60 ft., with about 15 ft. of clay overburden. The deposit, like all limestone in the district and known as the St. Louis limestone, is about 250 ft. thick.

The property, about 35 acres in extent, was taken over by the present owners in 1924, and the plant has since been greatly enlarged and improved.

Electric motor driven Keystone and Cyclone blast-hole drilling rigs are used, and a 1¾-yd. Bucyrus and ¾-yd. Erie caterpillar type steam shovel for loading. A ¾-yd. Little Giant gasoline-driven, wheel-type crane is also used to handle the building stone.

Two 8-ton Plymouth gasoline locomotives and three steam locomotives, hauling 5-yd. side-dump contractors' type cars, com-

Office, quarry and batching plant at Rock Hill



No. 1 or main plant of Columbia Quarry Co., near Columbia, Ill.

New fine grinding plant of Columbia Quarry Co., Valmeyer, Ill.

prise the present transportation equipment.

The primary crushing is done in a No. 10 McCully gyratory crusher, and from there the crushed material is carried in a 30-in. bucket elevator to a 40-in. by 18-ft. revolving scalping screen, the oversize being recrushed in a No. 10 Telsmith and a No. 5 Allis-Chalmers gyratory.

The recrushed material, along with that passing through the scalping screen, is carried by a 30-in. bucket elevator to two 48-in. by 28-ft. revolving screens, placed end to end, so that the sizes are distributed to two sets of bins.

The minus ¾-in. material is removed by jackets on the revolving screens and further sized over two 6-ft. by 3-ft. double deck vibrating screens equipped with ½-in. and ¼-in. mesh wire cloth (one Simplicity and one Niagara). The truck loading bins have concrete columns and floors, with timber construction above.

In addition to the crushing and screening plant a dry-batching plant was constructed in 1928 for use in concrete road building. The stone and sand for this plant are stored in bins located along one edge of the quarry and handled from them by belt conveyor and bucket elevator to the bins over the batcher. Both materials may be switched in on a railway track over the bins, or handled by dump trucks. Also part of the screenings are utilized in a concrete block plant of the Duntile Co. adjoining. Stockpiling is done with a 1-yd. Northwest gasoline crawler type crane.

The Grant Road plant, about three miles southwest of the city limits and on the Kirkwood branch of the Missouri Pacific Railway, was taken over at the same time and has been remodeled and enlarged and also electrified within the past year and a half. The quarry face here is about 60 ft. deep by 400 ft. long with 15 to 25 ft. of overburden, and a ¾-yd. wheel type Marion steam shovel is used for loading. The crushing and screening equipment consists of a No. 7½ Telsmith primary crusher, 26-in. bucket elevator, No. 5 Austin secondary crusher, revolving screen and 3-ft. by 8-ft. Universal vibrating screen. This plant has a capacity of about 350 to 400 tons per day.

The Denny Road plant is a smaller operation of about 300 tons per day capacity 6½ miles west of the city limits. The crushing plant consists of two No. 5 gyratory crushers, elevator and screen. This plant is also located on the Creve Coeur branch of the Missouri Pacific Railway.

Bussen Quarries, Inc.

Also in this district is the new plant of the Bussen Quarries, Inc., at Jefferson Barracks, 15 miles south of the center of St. Louis. Here the stone is mined from a 60-ft. bluff and moved to the crushing plant by trucks, where it is dumped to a hopper and fed on a 36-in. pan conveyor feeder to a No. 6 Williams "Super-Jumbo" hammer mill type crusher. From the crusher the material is carried up in a bucket elevator to a revolving screen and the rejects returned to the crusher. The smaller sizes are screened on a 3-ft. by 6-ft. vibrating screen. The screening, elevating and conveying equipment was furnished by the Stephens-Adamson Manufacturing Co. This operation was described in Rock Products, December 6, 1930.

Union Quarry Co. and Big Bend Quarry Company

The remaining operations, which are of the deep quarry type, might be roughly divided as to size into two groups: one group, including the Union Quarry and Construction Co., Big Bend Quarry Co., Tower Grove Quarry and Construction Co., Frank Ruprecht Quarry Co. and Eyermann Contracting Co., having capacities of about 300 to 500 tons per day, or 60,000 to 100,000 tons per year each, while the other group, including T. E. Cavanagh, Fehlig Construction Co., Hoffman Bros. Construction Co., Mutual Quarry Co. and John C. Steffen and Bros., have capacities of 100 to 200 tons per day, or 20,000 to 40,000 tons per year.

Of these the Union Quarry Co., at 4687 Natural Bridge avenue, in the northwestern part of the city, is probably the largest and oldest with a capacity of some 500 tons per day. It has been worked for 44 years and is now at a depth of about 250 feet.

The quarry proper covers approximately a city block, with the crushing plants and storage yards occupying another. Quarrying is done in shallow ledges with air drills, and the stone is loaded either by hand direct to skips or by a ¾-yd. Thew gasoline shovel to trucks which dump to the skips. The skips, carrying a load of 3 to 3½ tons of stone, are lifted up out of the quarry by two separate cableways serving two crushing plants. In each case the cable extends over the primary crusher, which is not enclosed, and the skip is unhooked

New truck loading bins of Columbia Quarry Co.

Another view of Rock Hill Quarry Co.

and dumped into it. A double drum hoist with a 100-hp. motor is used with the cableway, one drum for raising and lowering and one for traveling.

The two crushing plants are similar, the larger having a No. 6 Austin gyratory crusher, bucket elevator and revolving screen, all motor driven. Air for the quarrying operation is supplied by a motor-driven, Sullivan, angle-type, two-stage air compressor; and recently a fan and simple box-type dust collector has been installed to minimize the dust from the plant. Storage piles and a batching bin are served by a Thew gasoline crane.

The Big Bend Quarry Co., in Maplewood just west of the city limits, is a similar operation and under the same ownership. A small shovel is used in the quarry, which is now at a depth of about 150 ft., and the skips are hoisted by derricks. The crushing plant consists of a No. 6 Allis-Chalmers gyratory crusher, bucket elevator and revolving screen.

The main offices of both the Union Quarry and Construction Co. and the Big Bend Quarry Co. are in the Security building, St. Louis. Louis Skrainka is president and Morris Skrainka, secretary-treasurer.

Other Plants in the First Group

The Tower Grove Quarry and Construction Co. at 5926 Scanlan avenue, in the southwestern section of the city, has a similar operation, with a quarry 150 ft. deep, and using a cableway to handle the skips to the crushing plant. The crushing plant includes the same arrangement of small gyratory crushers, revolving screen and bucket elevator. All shipments are by truck. F. C. Webb is president and general manager.

The Frank Ruprecht Quarry Co. has a double cableway operation, with a quarry 400 to 500 ft. across and 150 ft. deep. Jackhamer air drills are used in quarrying and the stone is broken and loaded by hand into the skips which are then handled to the crushing plant by the cableways. A considerable part of the production at this plant is building stone or rubble stone. The crushing plant includes a No. 5 Austin gyratory crusher, bucket elevator, revolving screen, 4-ft. by 8-ft. Niagara vibrating screen for the smaller sizes, and a Williams "Little Jumbo" crusher. All machinery is electric motor driven.

The Eyermann Contracting Co., William J. Eyermann, president, at 5100 Virginia avenue, in the southern part of the city, operates a quarry similar to the others just

J. C. Billman, superintendent of Rock Hill plant

mentioned, using tracks and cars to move the skips in the quarry and a derrick to raise the skips to the crushing plant. The crushing plant includes a bucket elevator, revolving screen and No. 5 and No. 3 gyratory crushers.

This company also has a quarry near the center of the city at 1210 South Grand avenue, which has been operated for about 40 years, but is now being abandoned and used as a dump.

The other smaller quarries previously mentioned use the same general methods and include T. E. Cavanagh, 6529 Manchester avenue, in the western section of the city; Fehlig Construction Co., at 3500 Hickory avenue, adjoining the Eyermann Grand avenue quarry just mentioned; Hoffman Bros. Construction Co. at 2712 Wyandotte avenue in the southern section near the Virginia avenue quarry of Eyermann; the Mutual Quarry Co. near Watson road just outside the city limits to the southwest, and John C. Steffen and Bros. between Gravois and Union road just outside the city limits to the south.

Washington State Silica Plant in Operation

THE FIRST CARLOAD of raw silica from quarries above Marblemount arrived at the new mill of the Northwest Mineral Products Co., Burlington, Wash., recently. J. C. Granberg is manager.

Production will proceed immediately and rapidly enough to keep abreast of the market.

Five different silica products will be made by the mill at one operation. English fuller's earth, from the only deposit in the West, sand-blast, steel-molding sand and glass sand, gannister lining for electric furnaces, and sortings for chicken grit, in three sizes, are the various products.

Several more byproducts of the industry are untouched as yet, Mr. Granberg pointed out.

The new silica company will have no competition on the coast, with the exception of Belgian sand which bears an import duty.

Silica from the company's two quarries eight miles above Marblemount is some of the world's purest, being 99.56% pure. A prominent glass manufacturer stated he knew of but one quarry anywhere in the world yielding silica so pure. That one, he said, is in Australia. A million tons are in sight in each of the Northwest Mineral Products Co.'s Marblemount quarries.—*Burlington* (Wash.) *Journal.*

Sugar Company to Handle Phosphate Fertilizer

ARRANGEMENTS have been made by the Utah-Idaho Sugar Co. to handle the "Treble Super Phosphate" of the Anaconda Copper Mining Co. in the sugar beet growing districts in Idaho, it has been announced by W. Y. Cannon, manager of the Idaho district with headquarters in Idaho Falls. This is the same product which was used here during the past year, he said.

Results from the use of this phosphate on the soils of the Upper Snake River Valley have been so favorable that the sugar company believes farmers can derive a great benefit from its use, Mr. Cannon declared. The company, therefore, will be prepared to handle this phosphate for all farmers, whether growing beets or not.—*Idaho Falls* (Ida.) *Post.*

Development in the Cement and Aggregate Industries as Viewed by a Materials Engineer

By P. J. Freeman

Chief Engineer, Bureau of Tests and Specifications, Department of Public Works, Allegheny County, Pittsburgh, Penn.

THE YEAR 1930 has not witnessed any spectacular developments in the cement and aggregate industries, but there has been a general improvement in specifications, methods of testing and using these materials. Engineers and others are appreciating the need of more specific information concerning these materials which they have been using so comfortably in the past.

Cement

The changes in portland cement specifications inaugurated by the American Society for Testing Materials last year have become effective with a very decided increase in the strength requirements.

Specifications also proposed last year for high-early-strength portland cement have become tentative standard specifications of the American Society for Testing Materials. The methods of testing high-early-strength portland cement are identical with those used for regular portland cement with the exception that the tensile specimens are broken at the ages of one and three days.

The new strength requirements for ordinary portland cement are now 275 lb. per sq. in. tensile strength at the ages of 7 days, and 350 lb. per sq. in. at 28 days. High-early-strength portland cement shall show a tensile strength of not less than 275 and 375 lb. per sq. in. at the ages of 1 and 3 days respectively.

There has been a decided increase in the strength results obtained at early periods from the regular brands of portland cement and also new producers of high-early-strength portland cement are getting ready to market their products.

The demand for a comprehensive specification covering masonry cements is being felt since there are no less than twenty different brands of such cements now being marketed in this country.

Investigations and Tests

The durability of concrete in service is being more seriously studied than ever by many groups of engineers, and to this end intensive work is being done to develop reliable methods for determining the durability and soundness of aggregates by means of laboratory tests. It is felt that if a reliable laboratory test for soundness of aggregates can be established it should be correlated with field conditions by a thorough survey of service records in conjunction with the laboratory tests.

The sodium sulphate soundness test is still in favor although its limitations are recognized by those familiar with it under various conditions. Numerous laboratories are running comparative tests using actual freezing and thawing conditions in connection with the sodium sulphate soundness test, but up to this time no comprehensive information or data have been made available.

The effect of flat and elongated particles in mineral aggregates is being studied by the testing laboratories of the National Sand and Gravel Association and the National Crushed Stone Association. These tests appear to indicate that the presence of flat pieces is not nearly so serious or injurious as most engineers have been wont to believe. Further information on this important subject may be expected at an early date when the present researches have been completed.

Effect of Soft Particles

The effect of soft particles of coarse aggregate on the strength and durability of concrete is being studied, particularly by the Michigan State Highway Department, and a great deal more work should be done on this important subject. Undoubtedly the normal strength of concrete is reduced and the liability of deterioration under freezing and thawing conditions is greatly increased when soft particles exist in the coarse aggregates. Much of this effect on the strength and durability is dependent on the location of the particles in the structure and if these particles exist in the material the location in the field cannot be controlled.

A far more extensive investigation than any which has been completed up to date should be conducted so that general types of undesirable materials may be classified and the reduction of such materials brought down to the economic minimum.

Testing engineers are directing their attention towards abrasion and other tests for sand, and particular studies are being made in an attempt to devise specifications and methods for testing which will insure durability of the sand in concrete.

The need for simplification of sizes in the sand and gravel industry is being recognized, and some localities have put into effect a uniform set of specifications for those particular districts. The producers of sand and gravel and also stone and slag are co-operating with the Division of Simplified Practice of the U. S. Department of Commerce in an attempt to improve conditions.

More attention is being paid to the preparation of aggregates by the producers and greater care exercised to obtain proper grading. Vibrating screens are replacing circular revolving screens, particularly in slag producing plants.

There is a tendency among contractors to request the use of separately graded aggregates in order to produce greater economy in concrete construction. It is a wholesome sign when contractors are asking for improvement in specification requirements covering aggregates rather than having them presented by the specification engineers. Further studies should be made to determine the suitable gradings for such combinations. In some sections of the country what may be termed "Premium Aggregates" are being developed; that is, aggregates which have been thoroughly tested and the possibilities for economical combinations determined. This is a new thought in aggregate production wherein the engineers and producers may be advocating discrimination rather than standardization of the product. A number of producers are now employing research engineers for the purpose of making investigation in order that a better understanding of the value of their particular material may be obtained.

Correlation of Research

Various municipal, commercial and producers' laboratories are engaged in isolated problems of research on concrete materials for construction and a correlating body is badly needed to bring these various results into one organization for distribution. It is hoped that the Highway Research Board of the National Research Council may be financed and properly manned to take over this very important work. Without doubt, there is a great deal of duplication of effort which could be eliminated and rendered worth while by a central clearing house for research particularly in connection with highway construction.

A comprehensive survey of the various investigations which have been made, most of which are unpublished, would undoubtedly disclose a mass of valuable information which could be assembled for general use, and from such information more comprehensive programs could be developed. Engineers are realizing that we know "more and more about less and less" in connection with this subject of materials for concrete.

Preventing Segregation of Aggregates

A Summary of Devices Found in Practical Use and of Devices on the Market

By Earl C. Harsh and Walter B. Lenhart
Associate Editors, Rock Products

WHEN ANY MATERIAL such as crushed stone, gravel, coal, gypsum, etc., is allowed to fall to a bin or to any storage space or receptacle, there is a tendency for the finer material to accumulate near the center of the pile and the larger pieces to roll towards the outside.

Where there is a wide range in the sizes of the material, this condition, commonly called segregation, is more pronounced, and in many localities where specifications are very strict, has been the subject of considerable discussion as to how best to overcome it.

This segregation occurs when the material falls from the screens into the bins, and again when it is drawn from the bins into railroad cars, and if it is stock-piled, a further segregation takes place during that operation.

Such concentrates of fine material may be further increased by rains, so that the situation then becomes even more aggravated.

In any material which is to be used as the aggregate for concrete, this feature of the concentration of the dust or minus ¼-in. material is objectionable, as well as any segregation of the coarser material from the smaller particles, in that such lack of uniformity affects the uniformity and strength of the resulting concrete. These features of segregation are well known to most operators and need no further elaboration here. What we are most interested in, however, is how such segregation may be controlled or reduced.

"Elephant's trunk" used by Schoenfield Quarries Co., San Antonio, Tex.

Preventive Measures

Apparently there is no sure way of preventing segregation entirely, and the remedies tried and in use are only partially successful, but they do reduce the objectionable features to such a point that shipments of material have been made which without the use of segregation preventative devices would undoubtedly have resulted in the material being rejected by the inspector.

The fact that segregation cannot be completely controlled has led to repeated suggestions to narrow the limits of sizes, or to ship the sizes in separate cars, and then recombine them on the job. This, however, could be carried to such extremes as to work a hardship on the industry and probably not improve the quality of the resulting concrete correspondingly. Often where an evil exists, even though a minor evil, radicals may take the reins and force the industry to adopt extreme and unwarranted measures. Hence operators might well study the subject and adopt some corrective measures before the matter gets out of their control entirely.

Car-Loading Devices

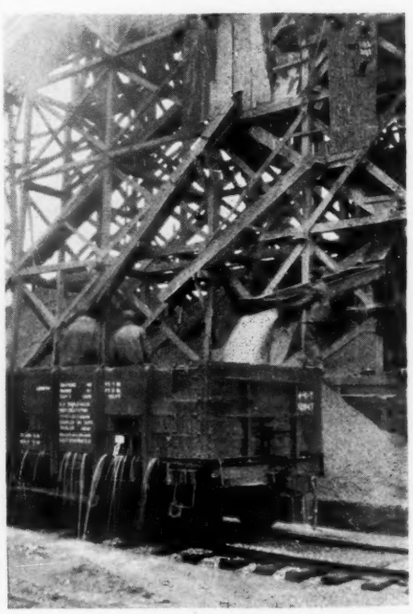
There are several devices for loading railroad gondola cars that are simple to install and require no additional labor for their operation. These may be broadly divided into two classes: (1) Remixing in the chute by means of baffles or Y-chutes, and (2) spreaders that scatter the stone in thin layers over the car floor.

Under the first class, a flexible steel spout has been successfully used. The spout or "elephant trunk," as it is sometimes referred to, is simply swung back and forth so as to spread the material over the car floor. An ingenious adaptation of this idea is used at the Schoenfield Quarries, Inc., near San Antonio, Tex., where the flexible spout is attached to a small light car that runs on industrial rails immediately below the different bin gates. The illustration showing the method of mounting was used in our "Hints and Helps" columns, but for convenience is reproduced here.

This idea can be used to advantage only where the stone or gravel is loaded without a final rinsing at the loading point.

When it is desired to rinse the product as the car is being loaded a variation in this scheme has been applied, as, for instance, at the Van Sciver plant of the Warner Co., at Tullytown, Penn. At that plant the various sizes are chuted to the gondolas by a specially designed chute which is hinged at the top and is swung back and forth during loading by a train of gears and levers operated by a small electric motor. The material, before reaching the swinging chute, is washed and screened as it is being loaded by passing it over a small stationary ¼-in. mesh screen mounted above the chute and on which water is sprayed. The fines are chuted to a sump. The device need not be motor-driven necessarily, as a man at the car could swing the chute back and forth during the loading operation.

In this same class of devices could be included that used by the Potts-Moore Gravel Co. at Waco, Tex. At this plant no loading bins are provided and the material is taken direct from the Gilbert screens and sluiced into the open gondola cars. The metal spout



Sluicing material direct from screens into open cars at plant of Potts-Moore Gravel Co., Waco, Tex.

Swinging chute at Van Sciver plant of Warner Co., Tullytown, Penn.

Traveling discharge at plant of Weston and Brooker Co., Columbia, S. C.

that is shown in the accompanying view is of such construction that it can be swung up or down or sideways by means of what amounts to a universal joint at the high end. The operator in loading a car swings the spout in all directions that are necessary to load the car in a level and uniform manner. By this method a large volume of water is chuted into the cars, which might be objectionable. This, however, could be overcome easily by lining the movable spout with a ¼-in. mesh screen and by-passing the water.

The Robins Conveying Belt Co. recently announced its floating chute, which is a device operated on practically this same idea.

Motor-Driven Device

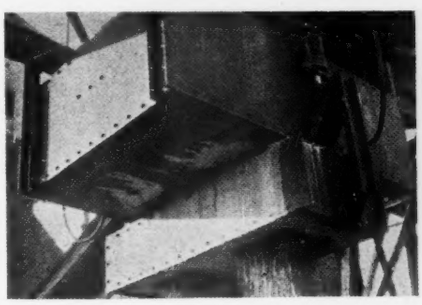
Few operators have made as complete a study of this matter of segregation as has the Weston and Brooker Co. of Columbia, S. C. Here a mixing belt running along under the bins and parallel to the loading tracks discharges the stone to a reciprocating hopper which is moved horizontally back and forth across the gondola to spread the stone while the car is moved along the track as the loading proceeds. At this plant they have a long straight track capable of taking care of 15 cars, past the loading point, and the cars are moved while being loaded by means of an endless cable and electric hoist.

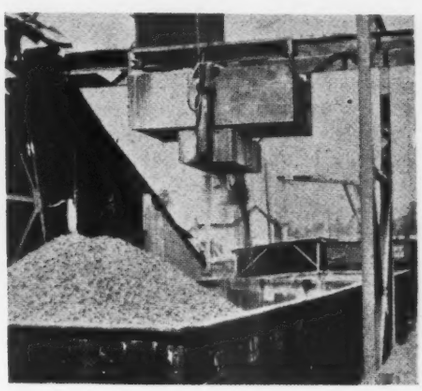
The reciprocating hopper or loader consists of two steel boxes, the upper and larger one being suspended from an overhead frame by four wheels so that it is free to move back and forth above the car. The upper box is 6½ ft. long, 4½ ft. wide and 2¼ ft. deep and open at the top to receive the stone from the conveyor. Swung below the larger box is a smaller one, 6 ft. long, 2 ft. wide and 15 in. deep. In the bottom of both boxes two 14-in. by 14-in. holes are cut, that are directly in line with each other. Both boxes travel back and forth across the car at a speed of 1 ft. per sec. The lower box is swung from the upper in such a fashion that it can be moved by means of an air hoist to divert longitudinally the flow of stone somewhat, so as to more evenly load the car, thus obviating the necessity of exactly spotting the car each shift.

The stone comes through the loading head in two streams about 30 in. apart and each carrying approximately the same grading. Since the spacing due to periodic shifting of the car by the pulling hoist was to be 60 in., a 30-in. spacing of the piles was used, as shown on the right of the accompanying sketch. Here, it will be noted, the second pile, always being lower than the first, checks the rolling of the first, which has not so far to roll as if there were only one stream. In fact, no distinct separation between these two streams is visible on the surface of the stone in the cars.

As to the crosswise loading from the reciprocating hopper, it is apparent that if the stone is laid down in thin layers, extending from as near each side of the car as it is possible to travel, there hardly can be any question about the various sections of the car containing the same grade material.

For operating this loading hopper an

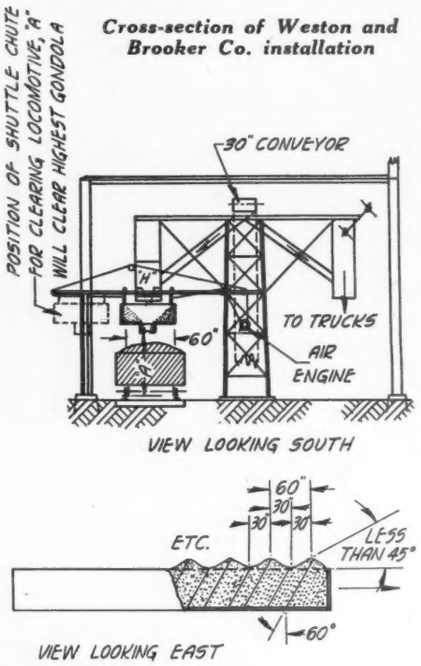




Details of installation at Weston and Brooker Co. plant

(Photos by courtesy of *Construction Methods*)

Ingersoll-Rand, Type DU, rotary air hoist was decided on for the reason that the rope speed was about correct, the reduction being taken care of between motor and drum, and for the reason that the operators knew they could make a quick turn at the end of the crosswise travel. In order to get the some speed in both directions, the Ingersoll-Rand Co. furnished a special rotating valve for the engine that would give equal power both forward and reverse. The rest of the



Cross-section of Weston and Brooker Co. installation

installation was made up by the stone company at that plant.

The travel of the reciprocating hopper across the car is over a distance of 60 in., and this movement is accompanied by means of an endless cable fastened to the hopper and passing through sheaves and with several wraps around the air hoist. An automatic reversing arrangement is included, so that the hoist is instantaneously reversed at each end of the travel. This feature of quick reversal was one of the principal reasons for using the air hoist, rather than an electric drive. However, very little air is consumed by the hoist.

The arrangement is hooked up so that it is started with the hand control of the rotary hoist, but just as soon as it moves into the range of the 60-in. automatic reversal mechanism, the hand control is released, and it continues to operate automatically. There are no other valves or levers to be handled by the operator. In case the car is moved too far or not quite far enough, an air valve is used to operate the air hoist connected with the lower hopper and thus divert the stream to compensate.

Thus once the gondola is set to start loading and the operation started, no further attention is necessary except to pull the gondola ahead 5 ft. when the proper height has been reached.

Indiana Gravel Plant Installation

Another very satisfactory rig for reducing segregation has been installed at the Terre Haute Gravel Co.'s plant at Terre Haute, Ind., by engineers of the Link-Belt Co. A belt conveyor taking one or more sizes of material from the bins discharges into a small loading hopper over the railroad track. Underneath this hopper is arranged a reciprocating spout or hopper which moves back and forth across the car as the material is loaded, and which is driven from the head shaft of the belt conveyor. In this way the material is loaded to practically the same level over the entire car, since it is built up by a series of layers as the spout moves back and forth. This device also calls for periodic movement of the car as loading proceeds.

Mr. Wayne Nattkemper, superintendent, recently advised that next winter they probably would lower this device closer to the car and thus reduce the distance the material falls.

At the Ensley, Ala., plant of the Birmingham Slag Co., the scheme is reversed. There the car is caused to shuttle back and forth under a wide loading apron so that consecutive thin layers of slag are built up in the car. An automatic reversing electric hoisting mechanism and endless cable control the car's movement.

Another suggestion has been to use a shuttle conveyor mounted over and paralleling the length of the gondola. Then, instead of moving the car back and forth automatically the conveyor is shuttled the length of the car, spreading the material in a wide swath and in thin layers.

There are also numerous devices in use

Hopper with reciprocating spout, at plant of Terre Haute Gravel Co., Terre Haute, Ind.

Use of baffles and deflectors

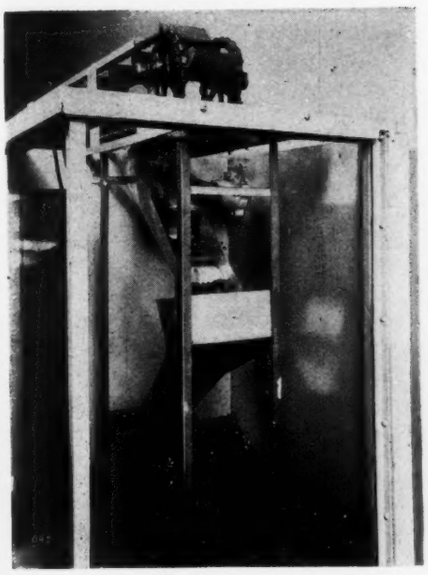
that depend on remixing the aggregates by baffles, deflectors, etc. These are useful for filling bins or similar containers, and are advantageous for car loading as well. One simple device is that shown in the accompanying illustration. This series of chutes is constructed of steel and is sufficiently rugged to withstand the pulling stresses set up by the downward movement of the main body of gravel as withdrawals are made from below.

A similar device is in use at the gravel plant of the Fort Worth Sand and Gravel Co., Fort Worth, Tex., where the apparatus performs the dual operation of reducing segregation and reducing breakage of the large-size pieces of gravel.

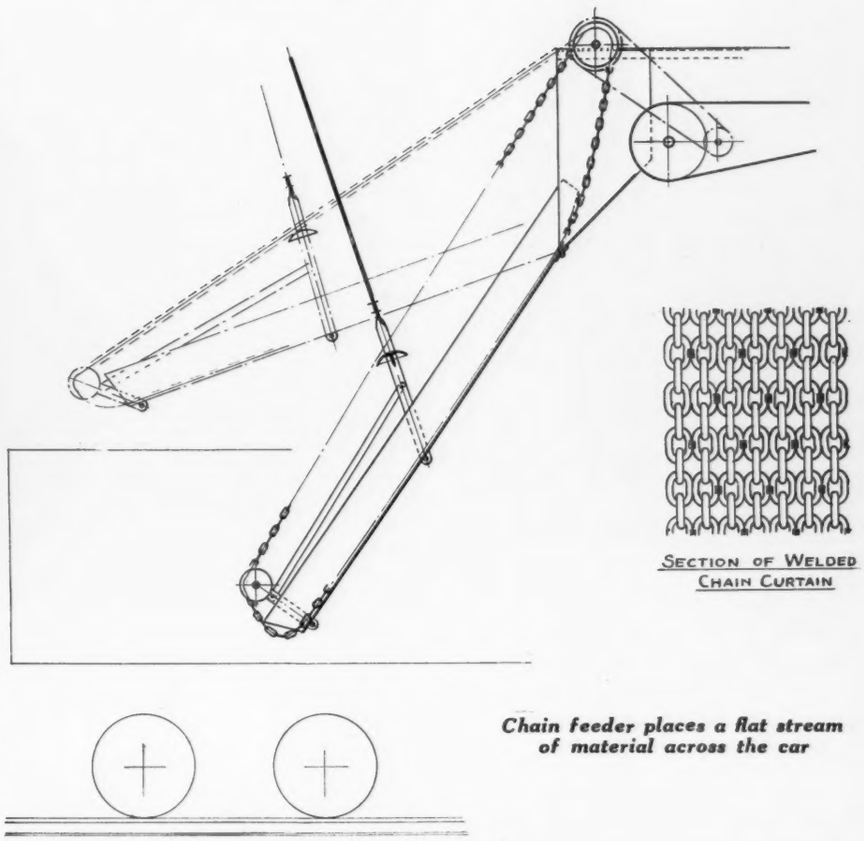
A ready-mixed concrete company in the South suspends a small platform from four ¾-in. steel cables which acts as a baffle plate and allows the material entering the bin to fall and strike against this platform. This device has some merit.

The Robins Conveying Belt Co. has elaborated somewhat upon the principle of using a baffle chute in its Adams "Avalanche" chute. The chute or series of chutes is so designed that the material eases itself into the bin in a series of waves or avalanches in which the mass of material moves forward as a whole without the individual pieces rolling or rubbing against each other. This device is used in the coal industry and has proved useful in reducing segregation and breakage.

Another device used in the coal fields is a car loader made by the Ross Screen and Feeder Co., which uses a modification of this company's chain feeder for the purpose



The "Avalanche" chute which functions to ease the material into a bin

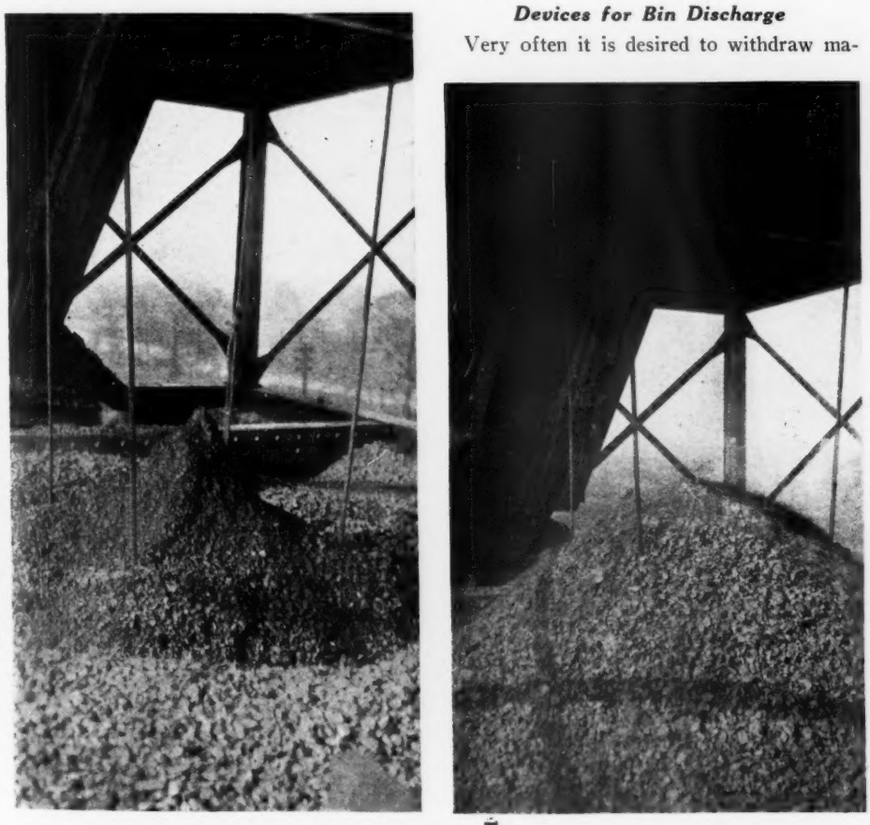


Chain feeder places a flat stream of material across the car

of loading coal or other material into an open gondola. This feeder is hinged so that it may be lowered into the end of a gondola car and deposits a flat stream of material across the car. The chains pull the material downward and deposit it close to the pile so that the fall is short and the tendency to roll thereby reduced. This device can be used for loading gravel or stone and at the same time it functions as a final screening and rinsing apparatus.

Devices for Bin Discharge

Very often it is desired to withdraw material from a bin in a uniform manner, as there is ordinarily a decided concentrating action of fines and oversize in this operation. The simplest method of accomplishing this is of course to withdraw from several points in the bottom of the bin simultaneously.



Suspended platform in bin over batchers overcomes tendency of fines to segregate from coarser material

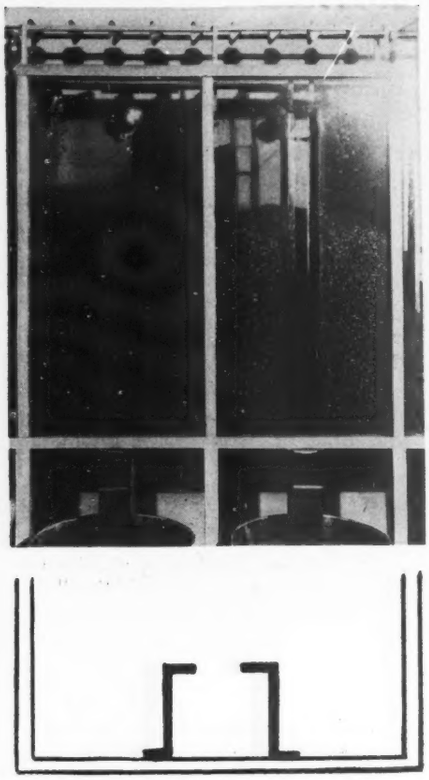
The Robins Conveying Belt Co. recommends for this purpose its Adams "Withdrawal" chute. This is a straight, vertical, rectangular chute with a slot or opening in one side wide enough to allow material to flow in from the top surface of the mass in the bin.

The picture is from an unretouched photograph taken with a 30-sec. exposure from a model of two bins with glass fronts. The bin at the left has no withdrawal chute and the one at the right has a wall type withdrawal chute. During the half-minute exposure of photographic plate, the gates of both bins were open and coal was drawn out at the same rate from both.

It will be noted in the left-hand bin that there was motion in almost the whole mass of coal, as it was forced down by the weight of the mass above, with a resulting constant grinding and crushing action.

In the right-hand bin the motion is only in the withdrawal chute and on top of the mass of coal at rest in the bin. This top layer is not under pressure when it moves to the chute, and the column of coal in the chute being of a comparatively small volume, is loosely packed and flows smoothly against the vertical sides of the chute.

The drawing of material from the entire

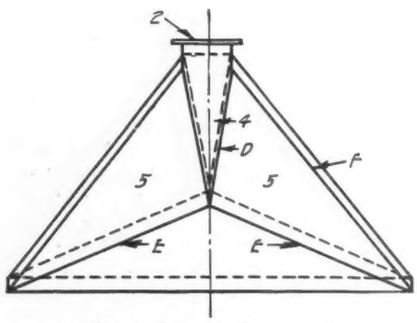


The withdrawal chute (right) takes out a column of material in a smoothly flowing manner. Diagram of chute below

area of the top makes a mixture of fines and lumps that is said to be more uniform than that drawn from a simple gate in the bin bottom.

A cross-section of the wall type withdrawal chute is shown in the sketch below the photograph. The withdrawal chute also may be of the "free-standing" type located at the center or any other point in the bin.

Patent No. 1,768,247, granted to Rolland Gardner, Lakewood, Ohio, relates to a feed chute or non-segregating chute. Referring to the accompanying line cut, Fig. 1, the material is fed into the inlet (2), where the particles will slide down the distributing surface (4) and successively over the distributing edges (d) on to the forwarding surfaces (5), and thence in turn over the foot edges (e) to discharge. By virtue of the arranged angle of slope of the respective surfaces, a substantially uniform retardation is said to be imparted to the respective particles, such as to neutralize tendencies for fine and coarse particles to run in respective segregation zones. In this manner, ungraded materials which it is desired to feed without incurring segregation may be forwarded and spread out into a wide discharge stream, without affecting the relative degree of admixture of sizes.



Special feed chute to prevent segregation

Laboratory studies in the prevention and theory of segregation were made by the National Crushed Stone Association and a report by A. T. Goldbeck, director, published in the *Crushed Stone Journal* of November, 1930. The report covers a series of tests conducted in the laboratory to devise means for preventing segregation and to determine the quantitative values of such methods as were tried. The quantitative values were determined by screen analysis of different parts of the piles formed.

For the laboratory investigations a model bin and also a model railroad car to a scale of one inch to the foot were used, in connection with stone screenings of correspondingly reduced size.

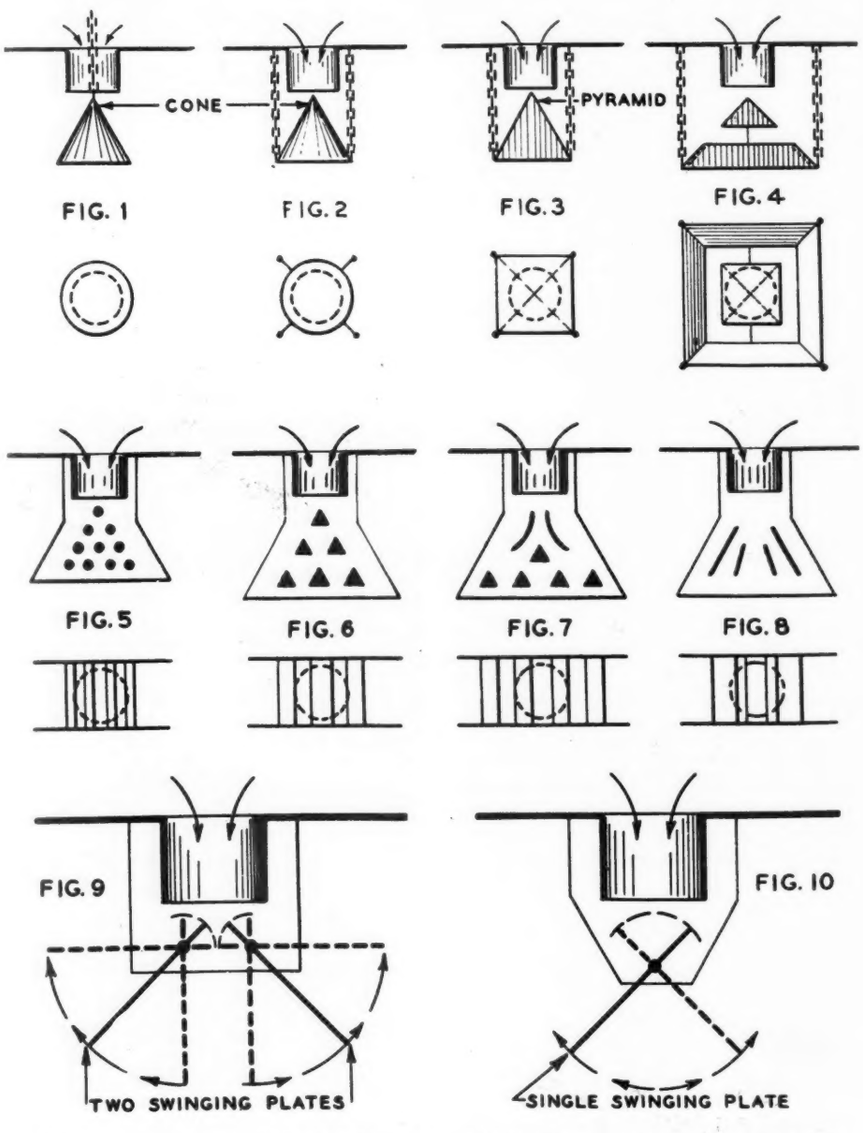
Ten different methods of dividing the stream to reduce segregation were tried, as indicated by Figs. 1 to 10 below, and their relative efficiencies judged by comparing the screen analyses of the outer and central portions.

Methods No. 1 to 6 inclusive showed no merit in the way of reducing segregation.

Method No. 7, however, showed some promise, as some of the fines were delivered to the outside.

Method No. 8, with adjustable plates, gave good results although considered to be rather impractical because of the necessity of changing the slope of the plates for different sized materials.

Methods No. 9 and 10, with respectively double and single swinging plates, also showed good results, two plates giving somewhat better distribution than one. Further studies are to be carried on.



Various experiments tried at laboratory of National Crushed Stone Association

Research Activities of the National Sand and Gravel Association

By Stanton Walker

Director, Engineering and Research Division, National Sand and Gravel Association

RESEARCH ACTIVITIES of the National Sand and Gravel Association during the past year have touched on a considerable range of subjects. Investigations of problems of special interest to the sand and gravel industry had been neglected for so long a time that, when facilities for research were made available to it, a large number of problems presented themselves. As a result, it has been difficult to concentrate on one problem to the exclusion of others. Therefore, during the past three years, it has seemed desirable, as well as expedient, to carry out preliminary work on a number of questions; always advancing toward the policy, however, of concentrating on one or more important projects and carrying them to a conclusion.

Since concrete represents the largest single market for sand and gravel, and since the characteristics of our materials exert an important influence on its quality and economy, it has been a logical development that much of our work should be directed to studies of concrete. The close relationship between the sand and gravel industry and the production of ready-mixed concrete has been recognized and considerable thought has been given to the problems of that industry.

Other important uses of sand and gravel have not been overlooked. Studies of the quality of aggregate particles, which will provide information of importance for any use of the material, have been carried out. Preliminary investigations in connection with the use of gravel as railroad ballast have been made which, it is hoped, will prove of considerable usefulness to producers and users of gravel ballast. The importance of sand and gravel in bituminous road construction has been recognized and, while no laboratory investigations have been conducted, considerable work has been done in assembling information resulting from field experience.

Current Studies

The studies of a research nature under way by the National Sand and Gravel Association consist, for the most part, of a continuation of work which was discussed in a preliminary way in our annual summary of a year ago. The nature of our more important work is indicated by the following brief resumé:

1. Effect of characteristics other than grading on concrete-making properties of aggregates. This investigation includes studies of mineral composition, surface texture, strength, shape and miscellaneous physical properties of aggregate particles.

2. Effect of size and grading of aggregate on quality of concrete. This investigation has dealt principally with coarse aggregates, although preliminary studies of fine aggregates have been made.

3. Methods of proportioning concrete. The development of a logical and scientific basis of proportioning concrete is essential to studies of aggregates for concrete, and is particularly pertinent to the investigations mentioned above.

4. Tests of sands. Our studies to date have been of a preliminary and exploratory nature, but they indicate the need for comprehensive investigation.

5. Characteristics of gravel ballast. The physical properties and service records of gravel ballast have been studied. Preliminary work has been done in a study of methods of testing the stability of ballast of different types and gradings.

6. Standard commercial sizes. The work of our standards committee has been continued in a survey of the Association to determine the acceptability of sizes proposed last year.

7. Field investigations. Studies of grading of untreated materials; designs of concrete mixtures; uniformity of grading of sands.

8. Miscellaneous tests. Tests carried out on behalf of member companies have comprised a larger part of our work than heretofore.

Physical Characteristics of Aggregates

Physical characteristics of aggregates, other than size and grading, have received a large measure of attention from several different investigators during the past few years. The differences in quality of concrete, on account of natural physical characteristics of aggregates of good quality, are much smaller than those resulting from such factors as proportions, curing, etc. Nevertheless considerable stress has been laid on them and they have exerted an important influence on the economic phase of specifications. Erroneous conclusions have been drawn from many studies which have been carried out, on account of unscientific methods of proportioning. There has also been a tendency to apply these conditions to broad classifications of aggregates such as represented by gravel and crushed stone.

On account of the economic importance of comprehensive information on this problem, the principal efforts of the National Sand and Gravel Association laboratory have been directed to its study during the past year. This investigation, which is still under way, may be described best by its title "Effect of Mineral Composition and Shape of Particles in Coarse Aggregate on the Strength of Concrete." It consists of concrete tests of several different aggregates of widely different natural characteristics. Its purpose is to develop information to show what characteristics of aggregates affect the strength of concrete and to evaluate the importance of each.

These tests are not sufficiently far advanced to justify a report of them at this time. It can be stated, however, from a study of them and from tests of other investigators, that the natural characteristics of aggregates exert a relatively important influence on the strength of concrete, and particularly on the flexural strength. Carefully controlled tests of different aggregates, falling within the range of quality of those commonly used for concrete, indicate that differences in flexural strength of approximately 25% may be caused by aggregate characteristics other than grading, soundness, or deleterious substances. Surface texture and strength of particles stand out as the most important factors. Angularity plays a relatively unimportant role; its principal effect is reflected in the workability of the concrete rather than the strength.

For a general discussion of the effect of aggregate characteristics, reference is made to Bulletin 5, "Effect of Characteristics of Coarse Aggregate on the Quality of Concrete," of the National Sand and Gravel Association, published this year, and to the discussion of W. F. Kellermann's report on "Effect of Type of Coarse Aggregate on the Strength of Concrete," published in the Jaunary 1929 issue of the *National Sand and Gravel Bulletin*.

Effect of Grading of Aggregates

Concrete aggregates are marketed universally as two individual commodities, fine and coarse. It is the problem of the engineer to prepare specifications for these separate materials which, under stated conditions, will furnish concrete of the desired quality with the greatest economy. In spite of the large amount of data available on

the effect of grading of aggregate, there is a surprising deficiency in information of direct help to the engineer in the solution of this problem. This lack of directly applicable information comes, paradoxically, from the fact that most of the tests have had for their purpose the development of fundamental principles of concrete proportioning. As such, they have been of great value and have furnished a necessary background to the study of the specific problems of the producer and purchaser of the commercial product.

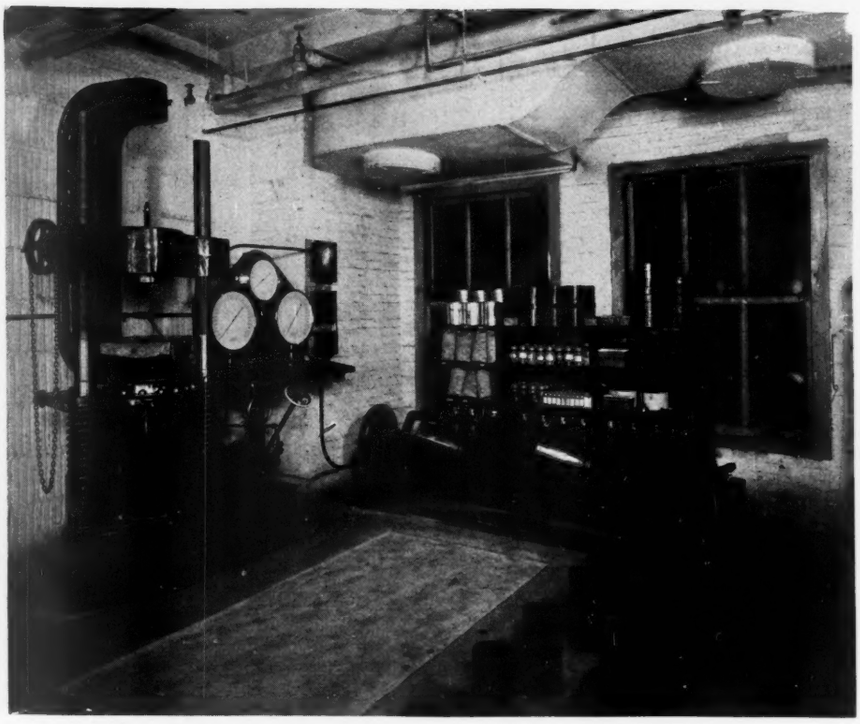
During 1929 the principal efforts of our research laboratory were directed to studies of grading and this work has been continued during the current year. These tests have had as their special feature the independent consideration of the fine and coarse aggregate. The more important of last year's investigations were discussed and certain preliminary data were included in our article in the January 4, 1930 issue of Rock Products. Further studies of the data have been made and a part of them published in detail this year.* Additional data have been obtained during the current year on this most important subject.

Our further studies of existing data and of our most recent tests have demonstrated, first, that further information on methods of proportioning is required before accurate studies can be made, and, second, that early studies have tended to over-emphasize the economic importance of large sizes of aggregates for producing concrete of a given strength. The effect of size and grading of fine and coarse aggregate on such properties of concrete as strength, workability, and volume changes will continue to occupy an important place in our research program.

Methods of Proportioning Concrete

In the preceding discussion frequent reference has been made to the inadequacy of our knowledge of methods for proportioning concrete. Results of tests to determine effects of aggregate characteristics on the quality and economy of concrete depend, in a large measure, on the method of proportioning used. The prime importance of a scientific method of proportioning, which will permit of comparisons of materials on an equitable basis, will be recognized at once.

The great value of researches which have been made and which have developed fundamental principles of concrete proportioning are recognized. It is believed, however, that these have not provided an exact basis for proportioning different kinds and sizes of aggregates in the most economical manner. In spite of the information developed by research, the quantities of materials for most concrete used in construction is dictated by specifications based on arbitrary proportions. Such specifications do not take into account the characteristics of different materials and, obviously, cannot provide for their most economical use.



General view of testing machine and abrasion machine

The laboratory of the National Sand and Gravel Association has, therefore, directed considerable effort to a study of the different methods of proportioning: (1) methods for obtaining a desired strength with any material; and, (2) methods for proportioning given materials in the most economical manner. The design of concrete on the basis of the water-ratio or the void-cement ratio falls in the first category. The use of a water-ratio which will result in the desired strength does not result, necessarily, in the use of the most economical proportions; the water-ratio method, of itself, does not provide a tool for the selection of the most economical proportions. The fineness modulus, the mortar-voids ratio, the various relationships between solids in the measured aggregates and aggregate solids in the finished concrete, the various maximum density curves (Fuller's curve, for example) are useful in the solution of the second phase of the problem.

It is the second phase of the problem which is of most importance in studies of different materials and to a study of which our efforts have been directed. In view of our current investigations of aggregate characteristics, it has been necessary for us to adopt a method as a partial, at least, solution to the problem. This method involves a consideration of the cement content per unit of volume of the concrete, the volume of mortar in relation to the voids in the coarse aggregate, the consistency of the concrete, and the water-cement ratio. For example, in a comparison of two different coarse aggregates of similar grading, it is our practice to proportion the concrete so that the cement content, ratio of volume of mortar to volume of voids in the coarse aggregate, and the consistency of the concrete as measured by the flow table are the same in the two cases. As an adjunct to the "mortar-voids ratio," a study of the volume of cement paste as compared with the volume of voids in the mixed aggregate offers promise of being valuable in the selection of comparable proportions.

Advance Over Other Methods of Proportioning

While it is not believed that this method provides an entirely satisfactory control of proportions, it is obviously an advance over arbitrary proportioning and certain other methods which have been proposed. It serves with considerable satisfactoriness where coarse aggregates of similar size and grading are being compared. One of its limitations, however, is that a mortar-voids ratio which is satisfactory for one size may not be satisfactory for another.†

It should be pointed out that no originality is claimed for the application of the methods of control suggested above. They have been used in one manner or another by several investigators. The "mortar-voids ratio" is one of the important features of the method of designing concrete advanced by Talbot and Richart.‡ In our laboratory

*Circular 7, "Effect of Addition of Finer Sizes to Gravel on the Strength of Concrete" and Circular 8, "Effect of Grading of Gravel and Sand on Voids and Weights," of the National Sand and Gravel Association.

†Data from which certain studies of these factors may be made are contained in our recently published Circular 7, "Effect of Addition of Finer Sizes to Gravel on the Strength of Concrete."

‡"The Strength of Concrete, Its Relation to the Cement Aggregates and Water," by Arthur N. Talbot and Frank E. Richart, Bulletin 137, Engineering Experiment Station, University of Illinois.

these methods have perhaps been applied to somewhat different problems than heretofore.

Further studies of methods of proportioning which will permit of materials being compared on an equitable basis are being carried out. Any final solution of the problem will probably have to await the development of a satisfactory method of measuring of concrete. So many different competent research agencies are working on this latter problem that we have not considered it desirable to investigate it at this time, except to keep in close touch with work which is being carried out.

Tests of Sands

Sands present an important field for investigation in which little work has been done. The effect of grading of sand on concrete and mortar requires study independently of the coarse aggregate. Methods of testing sands are inadequate and often result in the rejection of entirely satisfactory materials. Studies of the effects of impurities in sands should be continued; conventional tests do not always detect them nor properly evaluate their importance. The work on sands in our laboratory has been of a preliminary and exploratory nature. It has dealt with studies of grading, methods of testing, effects of impurities, durability of particles, etc.

Tests carried out in our own laboratory, as well as in others, demonstrate conclusively that the conventional conception of suitable grading and mortar strength is not a proper criterion of the quality of sands. Sands, which are more finely graded and which give a lower mortar strength than permitted by the usual specification, may be used satisfactorily in properly proportioned concrete. In conventional mixtures, such sands often give higher strengths than so-called well graded sands which produce high strength in mortar.

The "strength-ratio test," which involves a comparison of the tensile strength of mortar made from the sand under test with mortar made from Standard Ottawa sand, has a prominent place in most specifications. While its unreliability is generally admitted, no satisfactory substitute has been accepted. Its unreliability lies not only in the fact that the strength-ratio is not a good criterion of the concrete-making properties of a sand, but in the important effect which minor variations in manipulation have on its results. Preliminary tests carried out in our laboratory have shown that changes in quantity of mixing water of about 1% (10 to 11, for example), which did not change the consistency of the mortar outside the range commonly used in such tests, resulted in a change in strength-ratio of from 98 to 120%. Tests of the effect of pressure used in molding briquets have shown strength-ratios varying from 90 to 105%, depending on the pressure used; the pressures were within the limits of those which might occur for several different operators. While these tests are incomplete, they show the need for further investigations along these lines.

Our attention has been directed to several sands which give results in mortar-strength tests inconsistent with their apparent characteristics. In certain cases it has seemed evident that the low strengths were due to the presence of a film of an organic nature which was not removable by ordinary washing methods. Need for study to develop a practical means for removing such films is indicated. It seems more important, however, to determine if the deleterious effects indicated in the mortar tests are of importance in the concrete.

Durability of sands has received considerable attention by engineers during the past few years. Our research laboratory has studied methods of testing for durability, the work, up to the present time, being restricted to the adaptation of the accelerated sodium sulphate soundness test, commonly specified for coarse aggregates, to sands.

Studies of Gravel Ballast

Work started last year in a study of the characteristics of gravel ballast has been continued. Additional samples have been collected and the data from the laboratory tests are being supplemented by information relative to the behavior of the materials in service. These should offer valuable data for the preparation of specifications.

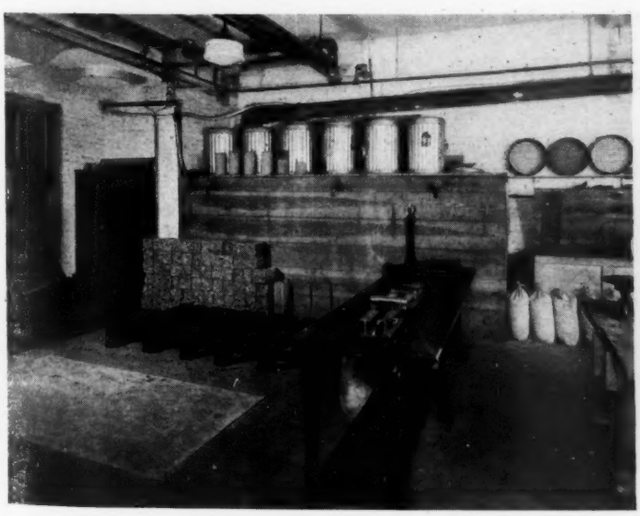
An important characteristic of ballast is the resistance which it offers to displacement under load—its stability. In order that the effect of grading and other characteristics of gravel on its stability may be studied, considerable attention has been paid to the development of a method for testing this property. The work which has been carried out thus far has consisted of studies of test methods. The methods which have been studied have for their object the measurement of the resistance of the ballast to displacement under load. One method, which offers promise of some value, involves loading the ballast in a flexible cylinder which is held from spreading by calibrated springs.

Standard Commercial Sizes

The development of suitable standards for commercial sizes of sand and gravel has not been a laboratory study, but it has, nevertheless, involved considerable research. It will be recalled that recommendations of the standards committee of the association, presented before the last annual convention, were accepted by the association as a basis for use in canvassing the sentiment of the industry. The sizes recommended were the following:

Material with not more than 5% coarser than the maximum size or 10% finer than the minimum size shall be considered as conforming to these requirements. In case of a dispute sieves with square openings shall govern.

Square sieves	Approximate equivalent round screens
No. 4—½ in.	¼-⅝ in.
No. 4—¾ in.	¼-⅞ in.
No. 4—1 in.	¼-1¼ in.
No. 4—1½ in.	¼-1¾ in.
No. 4—2 in.	¼-2⅜ in.
No. 4—2½ in.	¼-3 in.



General view of main laboratory of National Sand and Gravel Association

Screened aggregates in bins and apparatus used in separation

Result of Letter Ballot on Standard Sizes

During the current year each member of the association has been requested to vote on the following ballot:

1. Do you concur with the recommendations of the committee and of the convention that an effort be made to establish standard sizes for gravel?

2. If standard sizes are adopted, after following the procedure outlined in the three recommendations of the committee, will your company arrange to make your standard product conform to such of them as fall within the limits of your production? (It is understood that this agreement would not prevent the manufacture of special sizes, although, except for special purposes, their production should be discouraged.)

3. Do you concur with the committee's recommendations for standard sizes outlined in the table?

4. If you do not concur in the sizes recommended, what sizes would you suggest?

The sentiment of the members of the association, which represents a large proportion of the industry producing prepared sand and gravel, as expressed to the present time, is shown by the following summary of returns:

Favorable, 72% of tonnage of association.
Not voting, 6% of tonnage of association.
Ballots not returned, 20% of tonnage of association.
Negative or suggesting revisions, 2% of tonnage of association.

Field Investigations on Problems of Production and Use

Investigations of production problems and of methods of using our materials in the field deserve a more prominent part in our activities than they have occupied in the past. The size of our staff, however, affords sufficient excuse for the small amount of work along these lines. With the establishment of the district office in St. Louis, D. D. McGuire, district engineer, our facilities for carrying out field work, at least in that locality, have increased.

Mr. McGuire, in co-operation with member companies, has conducted an investigation of the deposits in the St. Louis territory with the view of determining what gradings can be produced most economically. The untreated product was analyzed for grading twice daily for 15 working days. An entire cross-section of the belt was produced for each sample. Changes of dredge boat location assisted in obtaining an average of the river. The assembled data were found to be most valuable as a measure of the efficiency of production and in guiding the preparation of specifications.

The Washington office has co-operated in the design of concrete mixtures for an important highway project, for a dam in which the materials of a member company were used, and has carried out a number of inspections of construction and field test methods.

Miscellaneous Tests

Investigations of special problems for member companies have occupied a more prominent part in our work than was the case in the first two years of operation of the laboratory. This is not only a logical development, but a valuable one, since it enables us to keep in close touch with the problems of most practical value. The specialized nature and variety of these problems make it difficult to outline them here. It is important to note, however, that in several cases they have suggested questions which will form the basis of more general researches on the same problems at a future date.

Publications Describing Researches Prepared as Rapidly as Possible

The policy of the National Sand and Gravel Association is to publish the results of researches carried out in its laboratory as rapidly as opportunity permits. Other investigators will recognize that the study and preparation of the data for publication is often as long and as laborious a task as the securing of them. Therefore, it has not been possible to publish the results of all of our investigations which have been completed to date. Certain of them are described in the following: Bulletin 5, "Effect of Characteristics of Coarse Aggregate on the Quality of Concrete"; Circular 7, "Effect of Addition of Finer Sizes to Gravel on the Strength of Concrete," and Circular 8, "Effect of Grading of Gravel and Sand on Voids and Weights."

The Young Mining Engineer Gets Government Advice

AN ABUNDANCE of excellent advice to the young engineer, equally applicable of course to the older engineer, is contained in Information Circular No. 6373 of the Bureau of Mines, this being excerpts from an address by Scott Turner, director of the U. S. Bureau of Mines, to the 1930 graduating class of Colorado School of Mines.

Among those points brought out by Mr. Turner were the value of co-operation, loyalty to employer and profession, and adaptability to new conditions. After showing some of the differences between college methods and those of the actual work-a-day world, he urged particularly the rapid adjusting of one's self to the changed conditions, the active co-operation with other and older men, the joining of technical societies and the writing of technical articles.

As a good example of the new order of co-operation in engineering, and the willingness to write and give to others detailed engineering knowledge and experience, is cited the scores of papers on mining and milling methods and costs now being published by the Bureau of Mines, which were made possible by the fine co-operation of leading engineers of the country.

Instrument Developed to Test Flow of Water Through Stone

AN INSTRUMENT recently developed at the Bureau of Standards is capable of measuring the permeability or rate at which water will flow through stone, it was stated recently by the chief of the Stone Section of the Clay and Silicate Products Division, D. W. Kessler, Bureau of Standards.

No natural stone, according to Mr. Kessler, is completely impervious to water. When placed under pressure water will flow at varying rates through different stones. However, Tennessee marble and Belgium black marble are nearly impervious and slate is relatively nonpermeable. The large crystal calcite marble used in the United States Patent Office building is fairly pervious to water, compared with marbles in general, he said.

Mr. Kessler furnished the following information:

The apparatus used at the Bureau of Standards for measuring the permeability of stone was developed primarily for the purpose of conducting experiments with stone to be used in the construction of the Boulder Canyon Dam. Engineers in connection with the dam were concerned over the amount of water which would seep through the 700-ft. concrete dam at the base under the enormous pressure it would be subjected to.

This problem was submitted to the Bureau of Standards where an instrument was designed to test the permeability of various types of stones which were proposed to be used in the concrete construction of the dam. The stones found to be the least permeable were naturally recommended for use in the dam.

How the Device Operates

The apparatus consists mainly of a heavy brass specimen holder and accumulator for producing and maintaining the desired water pressure. The sample of the stone tested is usually 2 in. in diameter and ¾ in. thick. This is placed in the specimen holder and placed under a constant known pressure for a given length of time. The amount of water which flows through the stone is measured and reveals the degree of permeability of the sample.

Most of the materials experimented with are found to be permeable enough so that the water can be measured with sufficient accuracy in an ordinary graduate reading to 1 c. cm. Some of the denser stones, such as marble, granite and slate, show such a small percolation even at high pressures that more accurate means of measurement must be used. In such cases a small vessel is filled with an absorbing material to absorb the moisture as it comes through the stone. By weighing the contents of the vessel before and after the tests, very small amounts of moisture can thus be measured.

Rock Products Investigations Conducted by the Bureau of Public Roads in 1930

By F. H. Jackson
Senior Engineer of Tests

A NUMBER of research projects of interest in the rock products field have been under way in the laboratories of the U. S. Bureau of Public Roads during 1930. These include a number of projects begun in 1929 or earlier and mentioned in last year's review as well as a number of investigations initiated during the present year, some of which are just getting under way. A brief resumé of the more important investigations follows.

During the summer of 1929, a 9-ft. concrete pavement, approximately one-half mile in length, was constructed for the primary purpose of studying the effect of increasing the amount of coarse aggregate in the mix considerably beyond the quantity generally used. Mixes containing as high as 5¼ parts of coarse aggregate measured in three separated sizes were tried. All of the strength tests which were contemplated in connection with this project have been completed and a report is now in preparation. Studies have been made of the following relationships as brought out by this study:

A Two-Fold Program

(1) Effect of increasing quantity of coarse aggregate (crushed stone, gravel and slag) in the mix when measured in three separated sizes and with the sand-cement ratio remaining constant, on

(a) Amount and uniformity of the transverse strength of slabs taken from the pavement.

(b) Similar data on crushing strength obtained from tests of cores drilled from the pavement.

(c) The water-cement ratios necessary for workable consistency.

(d) The homogeneity of the concrete, as measured by extent of honeycomb throughout the slab.

(e) Resistance to repeated freezing and thawing.

(2) Relations existing between strength tests on the pavement sections and the strength of beams and cylinders molded alongside.

In the above investigation, concrete sections were finished with both types of finishing machines in common use (the double screed and the single screed with and without tamper).

Analysis of the data indicates that valuable information has been obtained regarding such questions as effect of variations in water-cement ratio on strength of the concrete in the structure, relation between consistency and extent of honeycomb, effect of method of finishing on both strength and homogeneity, etc. A report will appear in *Public Roads* in the near future.

Durability of Concrete

Much attention is now being given to durability of concrete and the factors which affect it. Studies of this character are necessarily of long duration on account of the time required to produce conditions in the laboratory which are comparable with actual weathering. For this reason the first series of tests conducted by the bureau along this line, which was started several years ago, is only now being completed. These tests were for the purpose of ascertaining how the resistance of concrete to frost action is affected by the kind of coarse aggregate used. The tests indicate the extreme importance of determining definitely in advance of any construction whether the coarse aggregate to be used is of a durable character. Nondurable aggregates, even though they make concrete of the required strength, should never be used.

Two series of recently conducted freezing and thawing tests of concrete made by the bureau indicate in one instance that certain varieties of chert are exceedingly dangerous in concrete and, second, that limestones containing relatively small quantities of argillaceous materials may be satisfactory from the standpoint of durability when used in concrete having a low water ratio. An investigation for the purpose of learning more about the characteristics of chert as affecting durability is now under way.

Sand Investigations

Studies have also been initiated recently looking to the standardization of laboratory tests which will measure the durability of concrete sands. Sodium sulphate soundness tests, freezing and thawing tests and abrasion tests are being made on sands of widely varying mineral composition in an effort to throw light on this problem.

Another investigation on sands which has been under way some time and on which a report should be available during the coming spring is of interest. Engineers have long realized the inadequacy of the present standard strength ratio test for sand—that is, the test by which the strength of a mortar containing the sand is compared to the strength of an Ottawa sand mortar using the same cement. Tests are being made for the purpose of developing a more rational method than the Ottawa test. At the present time it seems possible that a test based on the well-known water-cement ratio strength relation may be developed. Such a test method has as a matter of fact been made a tentative standard by the American Association of State Highway Officials.

The durability of concrete as affected by the quantity of cement used is also being investigated. Alternate freezing and thawing tests are being made on concrete of the consistency used in pavements and containing varying quantities of cement ranging from 4.0 to 6.0 sacks per cubic yard. The problem is of importance because of the fact that, in designing concrete for strength, it is often found that the desired strength may be obtained with such small quantities of cement as to leave some doubt as to the ability of the concrete to resist weathering.

Abrasion Test on Coarse Aggregates

Dissatisfaction with the standard Deval abrasion test for coarse aggregates as indicated by certain of the state highway departments has resulted in the bureau undertaking a study of the Los Angeles rattler test, a method devised some years ago in the city of Los Angeles testing laboratory and now used as a standard test by California. The principal advantage claimed for this method is that the results are uninfluenced by the shape of aggregate particle; in other words, that crushed stone and gravel of comparable quality will give comparable results in this test, which is of course not true in the Deval test.

In last year's summary a program of bridge-floor slab tests being made in cooperation with the Port of New York Authority was described, and the importance of the tests was noted. These tests have been virtually completed, and a comprehensive report is being prepared. In this program three different aggregates were used, and the concretes were placed by each of four methods. Strength data were obtained for both plain and reinforced slabs. A large number of bond tests of embedded steel were made and information developed on the elastic and other properties of the concrete obtained by the various combinations and methods of placing. There is a demand for information which will assist in the development of bridge-floor slabs of less weight than those ordinarily employed, and the report of this investigation will add materially to the data now available.

Research in the National Crushed Stone Association Laboratory

By A. T. Goldbeck
Director, Bureau of Engineering, National Crushed Stone Association

ALTHOUGH the laboratory of the National Crushed Stone Association has been in existence only a little more than two years, its usefulness to the crushed stone industry seems to be well established, for each succeeding month reveals new problems demanding solution, and members of the association in ever increasing number are availing themselves of our research facilities.

The fact that many of our engineering specifications for materials still are written in an almost arbitrary manner, without the backing of adequate knowledge to permit of writing them more logically, continues to be a source of trouble, not only to producers but to consumers as well. One of the most important phases of the research work of the association is at present, and will continue to be, that of obtaining information which will be useful in drawing up specifications based on actual facts rather than on combined judgment.

Researches are needed in all of the fields in which crushed stone is used, including the several types of road construction such as concrete, bituminous types, waterbound and trafficbound macadam, in concrete structures, in railroad ballast, in sewage disposal and also in miscellaneous subjects having to do with sampling and production problems.

A number of topics concerning specification requirements are in urgent need of research, such for illustration, as the question of soundness, that of deleterious materials, gradation requirements, allowable percentage of stone dust, the effect of coatings, the effect of flat and elongated pieces, the physical characteristics of stone and their influence on different types of structures. It is somewhat appalling to find so great a lack of definite information existing with so basic a material as crushed stone. No doubt, however, research workers in other fields could tell the same story as to the lack of definite knowledge in their respective subjects.

Flat and Elongated Pieces

During the past year our research efforts laid along broad fundamental lines have been interrupted repeatedly by the necessity of solving the urgent problems of various producers, but, nevertheless, some basic results have been accomplished and these will be useful in helping in the future to draft better specifications for materials. One of these problems deals with the question of flat and elongated pieces. Many specifications for the coarse aggregates require that there shall be not more than 5% of flat and elongated fragments when the aggregate is to be used in concrete. The definition of flat and elongated fragments differs in various localities. In some states a flat piece is defined as one whose least dimension is one-fifth of its greatest dimension, and in other states flat pieces are those in which the least dimension is one-half of the greatest dimension. This very difference in definition shows a great variation in engineering opinion and illustrates forcibly a lack of knowledge as to what does constitute flat fragments.

Those who are familiar with the process of writing specifications know to what a wide extent specifications for materials are copied from one place to another, the original specification having been written by a group of engineers who have compromised with one another until a specification acceptable to that group has been evolved. All too frequently have the requirements of the specification been arrived at through engineering judgment rather than on the basis of facts derived from actual tests. As a consequence of this method, really useful materials are apt to be rejected. The point cannot be too strongly emphasized, therefore, that there is need for specific information based on investigations to determine real facts concerning specifications for material.

The problem of flat and elongated fragments was investigated because of the rejection of crushed stone from a quarry which produced more than 5% of fragments whose greatest dimension exceeded its least dimension by more than the ratio of three to one. The objection ordinarily raised by engineers to flat and elongated fragments is that such fragments interfere with the workability of the concrete and that they tear the surface of the concrete during the finishing operation; moreover, that the flat fragments lie in a horizontal position on the surface of the finished pavement and are, therefore, apt to be broken under the action of traffic leaving undesirable pits in the surface. Some suspicion was also thrown on the possible lack of strength of the concrete due to the flat pieces because of the extra water which might have to be used in the concrete to produce workability. All of these questions were made the subject of an investigation dealing with flat and elongated fragments.

A shipment of five tons of stone was received from the suspected quarry and the flat fragments were picked out by hand from all of the material greater in size than 1¼ in. The coarse aggregate was used with the same gradation as received and concrete was made up with this aggregate containing 0, 5, 10 and 15% of flat pieces by weight of the stone used. The proportions tried were 1:2:4 and 1:2:3½ by dry, loose volume. In

Synopsis

NO THINKING PRODUCER of crushed stone can any longer doubt the dollars-and-cents value to him of the research work of the National Crushed Stone Association. This resume of the work accomplished in two brief years is argument enough in itself.

The work covered by this association in the past year includes tests of the effect of flat and elongated pieces of coarse aggregate in concrete, particularly pavement concrete; the results prove that popular objections to elongated pieces, even to the extent of 15% of the coarse aggregate, affect neither strength nor workability anywhere near to the extent that improper grading does. Progress has been made in developing a proper gradation for stone sand. Tests are under way to develop the best gradation of coarse aggregate for workability of concrete. Soundness of aggregates has been tested by known methods, with the result that unsoundness of the concrete made with various coarse aggregates is seldom due to unsoundness of the coarse aggregates; it is more likely to be unsoundness of the sand, and of the mortar, or even of the cement. Tests on the expansion and contraction of concrete show that in some cases expansion due to moisture absorption is twice that in other cases; the effect of the type of aggregate has a bearing on the permeability of concrete. The stability of bituminous pavements is being studied; the type of aggregate is important. A device has been developed to prevent segregation of sizes in loading crushed stone. The proper gradation of ballast stone is being studied for the first time in any laboratory.

The concluding list of problems awaiting investigation and solution is comprehensive enough to include at least one problem of vital interest to every single crushed-stone producer in the United States.—The Editor.

the 1:2:4 mixes hydrated lime was also employed because it is required by the particular state using this material.

The concrete specimens were made up in the form of slabs 6 in. in thickness, 3 ft. wide and 6 ft. long. These were screeded off using the same methods of finishing as employed in actual practice and the difficulty of finishing was taken as a criterion of the workability of the concrete. Separating pieces were placed in the forms of these slabs so that after proper curing the slabs could be broken up into beams 12 in. wide, 6 in. deep and 3 ft. long. These beams were later used for strength tests.

It was found that the gradation of the stone, as supplied, produced aggregate which had a comparatively high percentage of voids and, therefore, it was decided to try other mixtures in which the gradation was improved so as to reduce the void content in the coarse aggregate. It was found that the gradation of the coarse aggregate played a very much larger part in producing poor workability than even 15% of flat fragments, and the effect of the flat fragments almost disappeared when the gradation of the stone was improved to give a low void content.

It will be unnecessary to discuss these tests in detail, as they have already been published, but it might be well to repeat the general conclusions which were drawn. These are as follows:

(1) Flat and elongated pieces, to a small extent, increase the percentage of voids in the stone aggregate and probably to a slight extent decrease the workability of the concrete because of the resulting decrease in the ratio of volume of mortar to the volume of voids in the stone. However, a considerably greater increase in voids takes place due to variations in gradation which may produce much harsher workability than produced by flat and elongated pieces.

(2) Flat pieces up to 10% in the 1:2:4 mixtures, and 15% in the 1:2:3½ mixtures, do not decrease the strength of the concrete.

(3) The indications are that the flat pieces do not lie in a position such as to cause trouble on the surface of a concrete slab.

Effect of Dust-Coated Stone on Properties of Concrete

In 1929, a series of tests was run to determine the effect of dust-coated stone on the strength and other properties of concrete and during the past year the one-year strength tests fell due. The previous investigations made at the end of 28 days and 3 months showed that even badly dust-coated stone, provided the coating was entirely of stone dust, did no particular harm to the concrete. The strength of the concrete containing even as high as 5.7% of stone dust was not materially lowered below that of the concrete in which the stone contained no dust. The percentage of reduction in either beam strength or compressive strength did not exceed 1½% for each per cent. of stone dust added. Moreover, the wearing qualities of the concrete containing stone dust did not seem to be impaired.

The one-year tests fully bore out the results of the previous tests made at 28 days and 3 months and for all practical purposes the concrete made with stone having 5.7% of dust was just as strong as that containing no dust. This investigation should be extended to a wide variety of rocks, for there may be exceptions to the above cited results.

Stone Sand

The possibility of using stone sand as a fine aggregate in concrete is becoming of increasing interest to the producers of crushed stone, for many of them have vast amounts of fine material piled up for which they do not seem to have developed a suitable market. There are instances in which stone sand has been used with remarkable success, notably in the state of Ohio. Stone sand seems to have the property of imparting extraordinarily high transverse strength in concrete and this is a property which is most desirable for concrete highway construction. The preparation of stone sand is an expensive process and consequently it cannot successfully compete with most natural sands. There are many localities, however, in which suitable natural sand does not exist and it is in these localities that stone sand should become particularly useful.

The problem of the optimum gradation of stone sand remains to be solved and, moreover, the use of stone screenings with coarse aggregate in a way such as to produce workable concrete requires solution. It would be desirable if means could be found for using stone screenings as a fine aggregate in concrete so that not too much preparation would be necessary except to insure the cleanliness of the material. By cleanliness in this instance is meant freedom from truly deleterious substances which may not include stone dust.

Preliminary tests have been made on the proper gradation of stone sand, but more investigations are needed to confirm the results thus far obtained. It is hoped that during the coming year it will be feasible to publish some useful information on this subject.

Workability of Concrete

Different states specify different gradations for coarse aggregate and within the same state a wide variation in gradation is generally permissible. Engineers have different ideas as to what is the best gradation for crushed stone to produce concrete having the greatest workability. Consequently an investigation was started on this subject. There is one particular difficulty, namely, that up to date no test for workability has been developed which can be regarded as an entirely satisfactory measure of this property. At the present time the judgment of the operator is the best means at hand for determining the relative workability of different concrete.

We have made a number of tests on workability using various gradations of coarse aggregate and using our judgment supplemented by the flow table and by the slump test to determine the relative workability of the concretes produced. Much useful information has been obtained and these tests will need further extension before it will be possible to give any very definite idea as to the best gradation under different circumstances. It is possible to make workable concrete with stone having any gradation, provided no limitation is set on the proportions of concrete used, but state specifications, in the majority, are still written in terms of fixed proportions which do not permit of any variation in the ratio of fine to coarse aggregate, and when such a specification is used it is then feasible to change the gradation of the coarse aggregate so as to produce the best results from the workability standpoint.

Soundness Tests

Years ago the soundness of aggregate entering into concrete construction was practically never questioned. Today, the reverse is the case. The soundness of materials is in the mind of almost every engineer using concrete and there is no more important problem confronting stone producers today than that of having a soundness test developed which will be truly indicative of the soundness of their material. At the present time, arbitrarily the sodium sulphate soundness test is being used, but there is no information available to interpret this test. Consequently a given number of alternations of the sodium sulphate test are arbitrarily taken as a criterion of the suitability of the rock.

Moreover, there are instances in which the sodium sulphate test causes disintegration of material which is sound in actual service. The reverse is also true; materials which are unsound in service are found to stand up in the sodium sulphate test according to reports from authoritative sources. A truly indicative test for soundness therefore is much to be desired. There are many phases of the soundness problem which have to do not only with the aggregate but also with concrete made from these materials.

If concretes disintegrate, the question frequently arises as to the reason for this unfortunate occurrence. Sometimes the cause is laid to the aggregate when more properly it might be due to something quite different. For illustration, it is already known that the amount of water used in the concrete mixture plays a vital part in affecting the durability of the concrete; and there are many other causes of disintegration. It is important, therefore, that a complete study of this subject, not only of aggregates, but of mortar and of cement and of concrete be made. We have initiated investigations on soundness using not only the sodium sulphate

test but also freezing and thawing tests and involving not only aggregates but mortars and concretes as well.

These investigations are already showing a number of facts which will be of value. There is no question that a high water-ratio is fatal to the durability of concrete, but there is the rather elusive fact that different sands behave differently in this respect. In one case we have a sand which is sound when tested alone but which seems to produce rather rapid disintegration of mortar, irrespective of the water-ratio used and irrespective of the proportions. Other sands which partially disintegrate when frozen alone do not seem to cause rapid disintegration of the concrete. The cement when tested in neat form disintegrates very rapidly in the freezing test. This may, or may not, be significant. The whole subject is in a state of chaos which needs clarification by an intensive investigation.

It has been our experience that concrete made with coarse aggregate which would be judged unsound on the basis of accelerated tests does not disintegrate except by virtue of the disintegration of the motar. The coarse aggregate invariably is left projecting above the surface of the concrete due to the rapid disintegration of the surface mortar. The question naturally arises as to just what degree of unsoundness a coarse aggregate may have in comparison with the mortar portion of the concrete.

Tests on the Expansion and Contraction of Concrete

It has been observed in the field that concrete made with certain types of aggregate expands considerably more than that made with others. The effect of this expansion is to cause blow-ups of the concrete in the spring of the year, and this happens not only in concrete highway construction but in concrete bases under bituminous types of pavements. To study this phenomenon, expansion measurements have been taken on concrete containing a wide variety of aggregates including crushed stones, gravels and slags of different weights.

In the case of two extremely light and porous slags (59.7 and 57.8 lb. per cu. ft., respectively) the expansion after 145 days, immersed in water, was 0.00049 in. per inch of length as against approximately 0.00027 in. per inch of length for limestone concrete made of a hard, dense limestone having low absorption. Light-weight slags (66.9 to 70.8 lb. per cu. ft.) produced concrete having a higher expansion than limestone concrete of the same proportions. The medium weight slags, however, varying from approximately 73 to 76 lb. per cu. ft. showed about the same expansion as limestone concrete, as did also the heavier slags in all cases. For illustration, one of the heavier slags weighing 84 lb. per cu. ft. showed comparatively low expansion, lower than limestone concrete. No conclusions are possible at the present time, for the matter is still being studied. It does seem to be outstanding, however, that some of the light-weight slags do produce higher expansion in concrete when immersed in water than the heavier materials.

Bituminous Investigations

During the past two years the laboratory has been busily engaged on problems in connection with the aggregates themselves and there has been scant time left to investigate certain important fields in which coarse aggregate is employed, such, for instance, as in bituminous concrete. The bituminous type of road is becoming increasingly important and investigations in bituminous concrete are, therefore, of much interest at the present time.

One of the important problems in bituminous concrete work is concerned with the question of stability. Several laboratories in the country have endeavored to perfect stability tests for coarse graded bituminous mixtures, but there is still some doubt as to whether any of these tests is entirely satisfactory for the purpose. A preliminary step in making stability tests must be that of the perfection of a stability testing device. During the past year we have devoted some attention to this problem. A stability machine has been constructed and preliminary tests have been made to determine its possibilities. The device may be used in a general testing machine and is so arranged as to obtain a measure of the shearing force required to disrupt the specimen. The bituminous concrete specimen is molded in a machine of the type devised by the Bureau of Public Roads and is in the form of a block 2¼ in. thick by 4 in. wide and 8 in. long.

Additional tests on bituminous mixtures have involved a study of the transmission of heat through bituminous concrete as compared with portland cement concrete. This problem has been investigated to only a sufficient extent to determine the relative heat transference. Apparently the conductivity of bituminous concrete is not greatly different from that of portland cement concrete.

Segregation

The problem of segregation of crushed stone in loading bins and cars is an important one in the crushed-stone industry. A great many carloads of crushed stone have been rejected merely because they have arrived on the work in a segregated condition, due in large measure to the manner of loading the cars from the bin. Had means been employed in the producing plant to avoid segregation, the rejection might not have taken place and the producer would have been saved a considerable amount of money. In the laboratory we have made studies in segregation, making use of a model and employing stone screenings instead of coarse graded crushed stone. We have found that segregation takes place in screenings in much the same way that it takes place in large size material and we have been able to devise means for preventing this segregation. The most successful device thus far tried consists merely of a single swinging gate which may be hand-operated during the loading operation. There is no doubt that a number of other simple means could be used to prevent segregation.

Railroad Ballast

Tests on stone have been made during the past year in conjunction with the Committee on Ballast of the American Railway Engineering Association. These samples have been submitted by various railroad systems and by producers. Much investigation remains to be performed in the study of railroad ballast. There has been little research work conducted in the past to determine a number of points concerning ballast. For illustration, we know very little about the proper gradation requirements, we know little about the relation between the physical tests of ballast and the behavior of the ballast when used under the track. Consequently the present ballast specifications throughout the country are written in an arbitrary manner much like many of the specifications for highway materials. This situation should not exist, for it leads, in some cases to poor results, in others to rejection of suitable materials and, in general, to an unsatisfactory condition from both the standpoint of the consumer and of the producer.

In addition to the investigations previously noted there have been a great many investigations done in the laboratory on a comparatively small scale, but they were necessary to solve individual problems of particular producers.

Problems in Need of Solution

There is one outstanding fact which is becoming increasingly apparent, namely, that the personnel of the laboratory is inadequate to solve promptly many of the research problems which are pressing. It will be interesting to cite just a few of the problems which have been placed before us for solution during the past year or which have come to our attention as problems in need of solution. These are:

The development of a really suitable cementing value test for stone screenings.

The determination of the value and the best method for using screenings as a means for the treatment of bad subgrades.

The development of a suitable test for determining the stability of bituminous concrete mixtures.

The investigation of stability of bituminous mixtures.

The investigation of resistance to cracking of bituminous mixtures.

Investigations in cold patch material.

Further investigations in the design of concrete for beam strength.

A study of stone sand and stone screenings as a fine aggregate in concrete.

A study of the effect of durability of ag-

gregates on the durability of concrete for highways.

Numerous studies in so-called deleterious materials in aggregates including dust-coated stone, soft fragments, flat and elongated fragments.

The effect of percentage of wear in the Deval abrasion test on the resistance to wear of concrete.

The effect of gradation of coarse aggregate and combined coarse and fine aggregate on the qualities of concrete as they affect workability, strength and economy.

Further studies on the effect of characteristics of aggregates on the expansion and contraction of concrete.

Standardization of accelerated soundness tests.

Further development of beam testing.

Tests for apparent specific gravity.

Studies of screenings for concrete products manufacture.

Development of a test for the stability of railroad ballast.

Studies in proper methods of sampling.

Studies in the prevention of segregation.

The development of a test to simulate service behavior of railroad ballast.

Studies in the gradation of ballast and its effects on stability, serviceability and drainage.

Investigations of the various physical tests of ballast now required by the American Railway Engineering Association, especially with regard to proper test limits, studies of sub-ballast and the value of screenings for this purpose.

Study of the durability of rock suitable for trickling filters and the development of proper specifications.

Various investigations in connection with specification requirements.

The above are merely a few of the investigations which should be conducted in the laboratory of our association and some of these will be undertaken during the coming year. The number of research problems which may be solved within a given time depends to a large extent on the personnel available for this purpose. Our progress should be hastened and this requires an augmented laboratory force. It is hoped that an industry so far-seeing and resourceful as the crushed-stone industry will not neglect an opportunity to advance through the medium of an adequate program of research.

Research Studies Made by the National Slag Association for the Year 1930

By Fred Hubbard

Director of Research, National Slag Association

THE TESTING LABORATORY of the National Slag Association has accomplished a considerable amount of work during the past year other than that which might be definitely termed "research." This work has consisted of routine tests on commercial slag from many different sources, coupled with rather comprehensive studies of plant practices in the matter of production and handling of commercial slag in order to have a more definite knowledge of the material from a practical point of view. These studies have aided in securing a greatly improved finished product from the producers. Much attention is being given by the Slag Association to this phase of the producers' problems as well as to the more purely research work.

Along the line of research one of the outstanding studies which have been made has been on the effect of varying percentages of calcium chloride on slag concrete as used with several different brands of cement. These studies were made on the tensile strength of standard mortar briquettes, compression strengths of 2-in. x 2-in. standard mortar cubes, compression strengths of 6-in. x 12-in. concrete cylinders and transverse strengths of 6-in. x 6-in. x 40-in. concrete beams. Four different percentages of calcium chloride were used in all mixes and strength tests were made at 1, 2, 3, 7, 14, 21 and 28 days. This investigation included the fabrication and testing of 630 briquettes, 630 cubes, 654 concrete cylinders and 210 concrete beams.

During the year a very comprehensive study was made on slag from twenty different sources of widely varying geographic location. Check tests were also made on gravel aggregate from six sources and stone aggregate from six sources. Nothing but strictly grade "A" material was selected in the gravels and stones, although hand-picked samples of slag were obtained which would not meet the more common specifications for unit weight. Slags were so selected as to secure the maximum range in unit weight or specific gravity which could be secured in a commercial product.

Very carefully detailed analyses were made on both the chemical and physical characteristics of all the aggregates in order to be able to study the effect of these characteristics in the resulting concrete. Cylinders and beams were fabricated for concrete strength tests at ages ranging from 1 day to 10 years. This is probably the most comprehensive investigation ever made on slag and slag concrete and the data should be of special interest to specification writers. This study included the fabrication and testing of 1674 concrete cylinders, 558 concrete beams and 41 yield test specimens.

A very comprehensive study of the effect of various mixes and water-cement ratios on concrete with slag used as coarse aggregate has been inaugurated. This series of tests was so planned and carried out as to give very accurate information on the effect of widely varying water-cement ratios, cement factors, consistencies and mixes. The study included the fabrication and testing of 1875 concrete cylinders, 100 concrete beams and 56 yield test specimens. Data from this investigation are intended to be of particular value for the use of contractors and engineers in the field in proportioning slag concrete under very dissimilar conditions.

A study of the effect of the use of coarse aggregate of varying sizes ranging from ⅜-in. maximum to 2-in. maximum has been carried out. The same consistency of concrete and cement factor was used throughout this series of tests, the variation being in the maximum size of the coarse aggregate, which of course necessitated several mixes for the same cement factor. This investigation included the fabrication and testing of 72 concrete cylinders, 25 concrete beams and 7 yield test specimens.

An investigation has been made of the comparative uniformity of compression tests and transverse tests of concrete. This question as to the best and most efficient method of measuring concrete strength has been raised at various times and this investigation was carried out to throw some light upon the subject with the work carried out as it is in the Slag Association laboratory. Compression tests were made on both hand-mixed and machine-mixed concrete, while the transverse tests on the beams were made on machine-mixed concrete only. It was interesting to note that the machine-mixed concrete gave more uniform results and somewhat higher results than were obtained by the hand-mixed specimens made according to standard A. S. T. M. procedure. This study necessitated the fabrication and testing of 48 concrete cylinders and 8 beams.

An attempt has been made to make research work of the Slag Association of immense practical value and it has been so definitely planned. It is the aim of the Association to continue work along these lines and to make both laboratory and field studies of such a nature as to be of both technical and practical value.

Research Work During 1930 in the France Stone Co. Laboratories

By Herbert F. Kriege, Ph.D.
In Charge, France Stone Co. Laboratories, Toledo, Ohio

RESEARCH SHOULD BE CONTINUOUS if it is anything. Hence an annual report of the work of a laboratory primarily interested in research will smack decidedly of a progress report. While there have been some new lines of endeavor during 1930, in the main the research problems undertaken have been continuations or developments of work previously begun.

Limestone Sand

Two years ago the report of our work in this journal contained a discussion of the study, commercial preparation, and successful use of limestone sand as fine aggregate in concrete. It may still be worth while to distinguish between this sand and what is usually known as "limestone screenings." Our limestone sand is wet-screened, water classified, washed, well graded material, meeting the usual state highway specifications for grade "A" concrete fine aggregate.

During the summer of 1928 a 10-mile section of concrete pavement was built just west of Toledo, Ohio, in which over 12,000 tons of this limestone sand were used. Since that time there has been practically no cracking, scaling, or sign of any other form of distress in this pavement, although some have appeared on other concrete highways recently constructed in this territory with natural sands. Additional streets and roads have been built each year so that the entire output of this limestone sand is now required for this purpose.

Gradation of Sand

Our laboratory has given considerable attention to the question of the best gradation of limestone sand when used in concrete. It is common knowledge that the usual specifications have been based upon natural sands as found. Therefore, much investigation is necessary to learn whether this limestone sand consisting of freshly broken, angular, unweathered particles should be produced to conform to the standards set for natural sands with their rounded, weathered particles. Our data have shown that the best gradation is not that usually found in bank and lake sands, with large qualities of the 30- to 50-mesh size fragments. Likewise, it was found that different sands could not be properly evaluated on the basis of the same water-cement ratio. Rather, an optimum water-aggregate ratio specific for each sand and gradation should be established and the comparison then be made on the basis of optimum conditions for each material.

Some study is being made of the function of the limestone sand below the 200-mesh sieve, commonly described as "silt." Obviously, this loosely applied term has been carried into our present day specifications with the thought of guarding against dirty sands, the "silt" being presumably finely divided loam, clay, and organic matter. Since these substances are practically absent from freshly crushed limestone particles, the term "silt," referring to all particles passing the 200-mesh sieve, is made to assume a very different and perhaps a false meaning. Some of these above mentioned problems are being studied in conjunction with R. R. Litehiser, chief engineer of tests, Ohio Department of Highways.

Separated Sizes of Coarse Aggregate

This year we were able to participate in a study of the effect of divided coarse aggregates upon the properties of concrete pavements conducted by the Michigan State Highway Department's laboratory. An 11-mile section of U. S. Highway No. 23 built between Ann Arbor and Milan, Mich., contains both gravel and stone in separated sizes when shipped to the job. The stone sizes were:

	No. 1	No. 2	No. 3
Passing 2½-in. (round)	100%	100%	
Passing 2-in.	90 to 100%	90 to 100%	100%
Passing 1½-in.	60 to 80%	½-in. 40 to 60%	85 to 100%
Passing 1-in.	0 to 15%	¼-in. 0 to 10%	0 to 10%
Passing ¼-in.	0 to 5%	8-mesh 0 to 5%	0 to 5%

These sizes were combined in various proportions at the batching plant. While the data on the transverse and compressive strengths found are not yet available, it was found that the workability of the mixes emphasized the superiority of the combinations of Nos. 1 and 2 over those of Nos. 1 and 3. This observation that a gap grading caused trouble in the finishing operation is worthy of consideration when so many engineers are giving attention to the subject of divided aggregates. Quoting from a letter from W. J. Emmons, director, Michigan state highway laboratory, we find the opinion, "from the standpoint of concrete uniformity, elimination of segregation, etc., we consider separate sizes to be very satisfactory."

Our first experience with slag shipped in two sizes came this year on a concrete base. The aggregate was divided at 1 in., a straight-line grading being maintained. Such uniformity of materials, wet concrete, and compressive strengths resulted that general satisfaction was felt on all sides regarding the experiment.

Gradation of Coarse Aggregates

One of the problems most constantly before us since the opening of our laboratory more than four years ago is the matter of the proper gradation of the fine and coarse aggregates for concrete. A part of our data appeared in an article in Rock Products, June 21, 1930, pp. 55-65, under the title "The 'Missing Link' in Concrete Aggregates." Attention was drawn to the need of thinking of concrete aggregate as a *whole* rather than as *fine* and *coarse*, each of which might be good within itself and yet make an improper combination with the other. When this broader view of the aggregate is taken, it is easy to prevent gap-gradings and overloadings on certain sizes, which produce undesirable conditions in the concrete. It was shown that the commonly specified omission of the intermediate sizes, ¾-in. to 10-mesh, was undesirable.

Co-operative Work

It was our privilege to help with the work of a section of Committee C-9, American Society for Testing Materials. The report of the work of this group was read by its chairman, Fred Hubbard, before the Society at its last annual meeting under the title, "The Relation Between the Abrasion Loss of Blast-Furnace Slag and Its Concrete-Making Properties." The data found by the committee showed that the loss by abrasion was not a true index of the qualities of slag for concrete aggregate. Neither does this test indicate any property which the weight per unit volume does not show more clearly and easily.

For some time we have analyzed the concrete specimens from our investigations for their true cement content by a method devised by the author in 1924. This method was recently presented, along with the analyses of over a hundred concretes of known cement content, to sub-committee 12, Committee C-9, A. S. T. M., for consideration as a possible tentative standard procedure.

Soundness and Durability

A great need is felt for a means of testing the durability of mineral aggregates and other materials. The sodium sulphate soundness test has several distinct advantages over the other forms of test used at present. However, misconceptions have arisen, and with them a multiplicity of test methods and variations, and even more ways of interpreting the results obtained. We have had the opportunity to use and study this soundness method extensively. Certain fundamentals in the procedure which have been largely neglected heretofore were presented in a paper last July to the sanitary division of the American Society of Civil Engineers. This material appeared in *Civil Engineering,* Vol. 1, No. 2, p. 120-2 (1930). A part of the paper had to be deleted to save space and this part contained the discussion of the test procedure from a purely chemical standpoint. Since such a discussion is not to be found in strictly engineering publications, it is our purpose to present this phase again, with the data we have gathered from the soundness tests of hundreds of mineral aggregate samples.

Correlating Tests and Service

It is a pleasure to report some progress in correlating soundness tests and service in the field. Academically, this may not seem so highly important, since our field service data and our laboratory results of such standard tests as abrasion, toughness, specific gravity, hardness, absorption, etc., are certainly without adequate coordination. Yet we would all like to know what accelerated soundness data mean in terms of years of satisfactory service.

P. D. Miesenhelder, assistant chief engineer, Indiana State Highway Department laboratory, has under observation hundreds of broken concrete beam ends from the transverse test. These ends are placed with their broken surfaces upward to expose the aggregates as well as the mortar to the elements. It is evident that such exposure tests on concrete containing aggregates of known degree of soundness should aid greatly in the proper interpretation of the tests for soundness in terms of durability in concrete masses.

It must be apparent that we have but touched upon some of the research work which has attended our ways this year. Those many animating or perhaps devitalizing problems which have been our constant companions have been left unsung because of their comparatively local interest.

Determination of the Effects of Quarry Blasts*

Beginning Made Especially To Aid Quarry Operators in Settling Much Disputed Subject

By F. W. Lee
Senior Physicist, U. S. Bureau of Mines

THE OBJECT of investigating the effect of quarry blasts is to find a method of determining the effects of quarry blasting operations on buildings at various distances from such operations and the permissible amounts of explosives that may be used without causing damage to the buildings. The type of vibrations set up by the blasts, the nature of the transmission of these vibrations, and the influence of rock formations on this transmission are some of the problems that must be considered primarily.

The first steps in the study consist of constructing the necessary instruments for measuring the displacement of the earth, and of calibrating such instruments to insure accuracy. Most of the apparatus used for seismic investigations is for the purpose of determining the time of transmission of seismic disturbances. The present problem is to find an accurate means for measuring the displacement of the earth by the shock of the blast in addition to the velocity of the propagation. Further than this, the displacement of the earth must be measured in three directions: In the direction of a line drawn between the instrument and the blast, in the direction normal to this line, and in a vertical direction. The inertia factor of the recording apparatus itself has a tendency to combine with the movements of the earth, resulting in a registration composed of the resistance of the instrument plus the displacement of the earth. The separation of these two factors is a necessary step in the accurate measurement of this displacement.

It will be understood from this that entirely new types of recording instruments must be designed, built, and checked. Since this requires fundamental scientific study and experiment, the results are necessarily slow and will demand a vast amount of careful and delicate manipulation in construction details. Investigations of this nature are begun with careful mathematical calculations and are furthered by the construction of such apparatus and with such modifications as may naturally suggest themselves in the course of their development. Seismic recording apparatus, such as will not introduce errors due to its own inertial factor, is being constructed and tested.

In addition to the above it is necessary to have another piece of apparatus which may be used for calibrating this recording device in such a way as to leave no doubt concerning its ability to measure the displacement of the earth. This calibrating instrument must be capable of administering vibrations at all frequencies normally found with any gradation of amplitude. It must be capable of administering vibrations of a specified dimension within certain limits of error. It must be flexible enough to modify these amplitudes as desired. Such standardization apparatus requires a large amount of study, time and effort, but is truly essential for successfully carrying on this investigation. Because of the sequential nature associated with fundamental investigations of this kind the progress at the beginning is exceedingly slow, and the operators are asked to be patient in this matter.

Special Structures to Be Tested

Application of seismic measurements to field operations must necessarily await the completion of the recording instruments. Different types of structures will be erected and a careful study of the damages caused to them by vibrations from blasting operations will be recorded. This investigation will include a study of the nature of failure of building material and the correlation of the vibrations necessary to produce them. This investigation may be divided into the following stages:

(1) The determination of the proper types of seismic recording apparatus, (2) the methods for calibrating this apparatus, (3) the study of the damages to different types of structures caused by the vibrations from blasting operations, and (4) a study of the types of failure inherent to various building materials when correlated with the vibrations necessary to produce the same.

The results of this work will help the quarry operators and contractors by giving them some standard by which to gage the effect of their blasting operations on buildings in the vicinity of the quarries. Also, these results will serve as a guide to state inspectors in determining the maximum amount of charge which may be safely used in a single shot at a given location. Since the geological strata vary at each quarry, it will be necessary to determine the vibration characteristics at each location. It is hoped that some simple apparatus will result from this work which may be used by the operators to regulate their blasting operations in order to avoid unnecessary damage, which is often a source of litigation.

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Highway Research in 1930

By R. W. Crum
Director, Highway Research Board

AT THE MEETING of the Highway Research Board last year, a report was presented which discussed the principal problems in the highway field and outlined a research program. The plans for the activities of the Board in furtherance of the program were announced. The reports presented this year indicate that substantial progress has been made. Important results of recent research work were reported at the meeting and analysis of many important problems and outlines for the needed research work were presented.

Research Projects Outlined

The list of projects of interest to ROCK PRODUCTS readers for which definite suggested procedures are now ready is as follows:

2. Stabilization of subgrade treatments.
3. Correlation of physical soil tests with the soil types as established by the U. S. Bureau of Chemistry and Soils.
5. Effect of traffic on rigid pavements.
7. A study of temperature as affecting highway construction.
10. Bituminous mastic mixtures for the cushion or bedding course under brick pavements.
12. Concrete base courses.
13. Stresses caused by volume changes in concrete.
14. Strength of concrete best suited in a concrete base that is to carry a bituminous wearing surface.
15. Relative effectiveness of various non-skid surfaces for bituminous pavements.
16. Design of bituminous paving mixtures to resist cracking due to temperature variations.
17. Low cost road types—accelerated tests of untreated surfaces.
18. Low cost road types—accelerated tests of bituminous surface treatments.
19. Low cost road types, aggregates for bituminous surfaces.
20. A study of stresses in road slabs by means of models.
22. Determination of causes of structural and material defects in existing bridge structures.
23. Economic considerations in design and construction of low cost bridges.
24. Behavior of concrete structures during the strength developing period.
25. "Effect of flat and elongated particles in mineral aggregates."
26. "Relation between durability of concrete and durability of aggregates."

There are 39 projects in all, those omitted relating to grading, traffic control, etc.

There are also in the reports of the various committees, numerous suggestions for needed research that have not yet been outlined in detail.

Active Projects

It is a major function of the Board to organize or to assist in organizing definite projects looking toward the solution of specific problems. Such projects involve the carrying on of experimental or other research work by one or more agencies under the more or less general supervision of a committee or special investigator. There are no set rules for the organization of such projects. Any arrangement that will produce results has the support of the Highway Research Board. The best progress can be made when someone can devote a large part of his time to the project. When problems outlined by the general committee reach the stage of definite organization for research they are listed as Highway Research Board Projects. Active projects are:

1. A study of state, county, township and municipal taxes for highways and the relationship between road and general property taxes in the various states. Sponsored by the Committee on Finance. This is a co-operative project between the U. S. Bureau of Public Roads and the University of Wisconsin under charge of Dr. H. R. Trumbower.
2. Co-operative study of county and township highway financing, administration and survey of physical conditions of such roads in North Carolina. Sponsored by the Committee on Finance. Co-operating agencies: U. S. Bureau of Public Roads, North Carolina State Highway Commission and North Carolina State Tax Commission. Investigation in charge of George G. Clark.
3. "Analysis of highway costs." Sponsored by the Committee on Transportation. Special investigator furnished by Iowa State College. Co-operating agencies: Highway Research Board, Iowa Highway Commission, Connecticut Highway Department, Iowa State College. Chairman of committee: T. R. Agg. Special investigator: Ray Paustian.
4. "Methods for determining economic value of small drainage structures." Sponsored by Committee on Design. Co-operating agencies: Highway Research Board, Highway Departments of Georgia, Tennessee, California, Virginia, Wisconsin, North Carolina and Maine, Iowa State College and U. S. Bureau of Public Roads. Chairman of committee: R. W. Crum.
5. "Curing of concrete pavement slabs." Sponsored by Committee on Materials and Construction. Special investigator furnished by Highway Research Board. Co-operating agencies: Highway Research Board, U. S. Bureau of Public Roads, Portland Cement Association, Ohio State University, State College of Texas, and State Departments of Iowa, Wisconsin, Minnesota, Illinois, Missouri, Michigan, Ohio, Kentucky, Tennessee, Georgia, North Carolina, West Virginia, California, Texas, Washington, Kansas, Pennsylvania, New Jersey, Rhode Island, Connecticut, Maryland and Virginia. Chairman of committee: F. C. Lang. Special investigator: Fred Burggraf.
6. "Correlation of research in mineral aggregates." Sponsored by Committee on Materials and Construction. Co-operating agencies: Highway Research Board, U. S. Bureau of Public Roads, University of Michigan, American Society for Testing Materials. Chairman of project committee: W. J. Emmons.

There are three more active projects, relating to traffic study and control.

Progress reports of the projects on highway costs, curing of concrete, and traffic capacity were made at this meeting.

Projects in Process of Organization

1. Dust laying materials and methods—Special investigation to be conducted by the staff of the Highway Research Board.

2. Roadside planting—It is expected that the organization of these projects will be completed early in 1931.

Research Information Service

The Highway Research Board regards the establishment of an adequate Research Information Service as a most important duty. It was announced that arrangements have been made for sufficient additions to the staff of the Board to prosecute this work intensively during the coming year. A census of highway research projects of the United States Government, State Highway Departments, Engineering Colleges and commercial research laboratories is now in preparation. This department will be in charge of Fred Burggraf. Mr. Burggraf, who was formerly a research engineer with the Illinois State Highway Department, has been recently conducting the special investigation of the Board on Curing of Concrete Pavement Slabs.

Summaries of the Papers and Reports

(Highway Research Board Meeting, December, 1930)

COMMITTEE ON MAINTENANCE—"Maintenance Costs," H. K. Bishop—Description of some of the ramifications involved in attempting to compare maintenance costs in different jurisdictions, such as quality of maintenance, accounting methods, equipment, traffic, width, and climate. "Repair of Pave-

ment Settlement," W. H. Root—A description of a unique method for raising sections of pavement that have settled by pumping mud through holes in the slabs, with operating and cost data. "Removal of Ice from Pavements," B. C. Tiney—Attention is called to the need for an investigation to develop information relative to the most effective and economical materials and methods for use in dealing with icy road surfaces. "Fillers and Cushion Courses for Brick and Block Pavements," J. S. Crandell —The ideal filler to meet the conditions set forth in the report has not yet been found. Some experiments that are under way but not yet ready for study are mentioned.

"THE DESIGN OF A CONCRETE MIXTURE"—Bert Myers and Mark Morris—Detailed description of the steps involved in the design of a mixture for concrete to be made of certain specific materials to have an average crushing strength of 4000 lb. per sq. in. at 28 days, to be of suitable consistency for pavement work, and to require the use of predetermined quantities of materials. The design was based upon the methods proposed by Talbot and Richart with some variations. Previous experience with one of the materials used in this case was reported in the Seventh Proceedings of the Highway Research Board. Use of the designed mix on fifteen miles of pavements, showed that the concrete was of satisfactory consistency, that the average strength was slightly in excess of requirement, and that cost of materials was 0.03% less than estimate.

COMMITTEE ON MATERIALS AND CONSTRUCTION—"Determination and Classification of the Important Characteristics of Bitumen for Use in Surface Application, Mixed in Place Surfaces, etc."—J. E. Myers—Discussion of the characteristics of bituminous materials that are of most importance in the construction of earth, gravel, broken stone or macadam, and mixed bituminous roads, as developed by research and experience. Also the methods of tests for these characteristics are described. The type of bitumen to be selected depends largely upon density of surface and relative size of voids. Tars of low viscosity and low pitch content, or petroleum products of low viscosity, low cementing value and slow drying quality should be used on clay, sand-clay, loam, loam gravel or for priming course on water-bound macadam roads, since such roads are dense and have relatively small voids. On more open road surfaces such as sand, sand-gravel, or macadam which has been primed with low viscosity materials, tars of high viscosity and high pitch content or petroleum products of high viscosity, high cementing value, and quick drying quality should be used. "Recent Developments in Construction Methods and Appliances"—An illustrated discussion showing the latest types of all kinds of equipment peculiar to road construction, and tracing the relationships between improved road work, lowered costs and machinery development. Improvements have been brought about principally through (1) changes made necessary by reason of modifications in construction practices, (2) the adaptation of existing devices to new uses, and, (3) refinements and improvements made primarily for the purpose of increasing operating efficiency. Attention is also called to some further improvements, the need for which is apparent.

Flat and Elongated Particles

COMMITTEE ON MINERAL AGGREGATES—"Effect of Flat and Elongated Particles in Mineral Aggregates," Stanton Walker—The purpose of the report is to cite whatever of definite information is available on the effect of flat and elongated particles and to suggest procedure for investigations. Although specifications have commonly drawn discriminatory lines against such material, there are little data upon which to base definite requirements. Research conducted by the National Crushed Stone Association and the National Sand and Gravel Association indicates that flat and elongated particles in the amounts to be expected in practice (10 to 15%) do not have deleterious effects upon workability, strength, finish and quality of surface of concrete. Some tests reported by Gilkey on specially prepared aggregates where the coarse aggregate consisted entirely of flat particles indicated some weakness. It is concluded that further investigations are required before generally acceptable conclusions can be drawn and suggestions for procedure are made. "Relation between the Durability of Concrete and Durability of Aggregates," F. H. Jackson—Basic requirements for durability are: the use of sound and durable aggregates, and maximum resistance to the entrance of water. The aggregates play a double role since the range of sizes plays an important part in producing impermeability. The characteristics of aggregates which affect their durability in concrete, and the effects of other factors such as permeability, water absorption, etc., are not well understood, and thorough investigations are needed. Concerted laboratory studies looking toward the formulation of standard tests for durability, and field investigations to correlate laboratory and structural experience are urged. Outlines for research work are presented.

"DURABILITY OF CONCRETE IN HIGHWAYS AND HIGHWAY STRUCTURES," C. H. Scholer —General discussion of the factors involved. . . . Types of disintegration observed as evidence of a lack of durability; Report of laboratory and field investigations of durability as affected by methods of testing, size and shape of specimens, methods of sampling, character of aggregate, quality of cement paste, permeability and absorption as a factor in disintegration, and effect of water-proof coatings. An accelerated freezing and thawing test is presented as a means of testing the resistance of concrete and concrete aggregates to weathering.

SPECIAL INVESTIGATION—"CURING OF CONCRETE PAVEMENT SLABS"—Progress report setting forth the facts established by study of the available data with respect to strength, surface scaling, and volume changes as affected by the various well known curing methods, together with the tentative conclusions drawn by the committee, and summaries of data collected.

COMMITTEE ON DESIGN—The committee has outlined in detail needed research on the following problems: Grading, Stabilization of Subgrade Treatments; Correlation of Soil Types with Tests; Classification of Tires; Effect of Traffic on Rigid Pavements; Relation between Excessive Rainfall and Extreme Flood Flow; Temperature; Stream Stabilization and Control; Depth of Frost; Bituminous Mastic Cushion Courses; Joint Fillers; Concrete Base Course; Volume Changes in Concrete; Non-Skid Surfaces; Cracking of Bituminous Mixtures; Models for Study of Road Slab Stresses; Highway Structures.

"THE RELATION OF CERTAIN FROST PHENOMENA TO THE SUBGRADE," Burton and Benkelman—Pavement condition studies demonstrate the need of research pertaining to frost action in subgrade soils. Over 50% of all pavement failures are attributed to differential heaving or expansion of subgrade on freezing. Field studies disclose possibilities of recognizing soil profiles, conditions, textures and associations dangerous from the standpoint of excessive heaving. Field results show that excessive heaving very often occurs in soils of particle size larger than that in which in segregation it occurs in laboratory. Recent laboratory investigations in Michigan indicate that alternate freezings and thawings of subgrades beneath the ground surface may be the primary cause of excessive heaving in soils having a particle diameter size larger than .005 millimeters. The results of investigations are being applied in practice, over two hundred locations having been given special treatment to prevent subgrade heaving during 1930.

"COST ECONOMIES IN CONCRETE BRIDGES," C. B. McCullough—A resumé of current structural research resulting in a theoretical discussion which shows that large first cost economies can be effected by means of a fuller utilization of the elastic properties of the structural frame. By the adoption of a monolithic elastic frame the entire structure is put to work, thereby not only effecting a distinct saving in yardage, but also operating to eliminate expansion joints, thus lessening maintenance expense.

COMMITTEE ON FINANCE—Announcement with outlines of work on two highway research projects inaugurated by the committee for the purpose of studying the relation of state and county taxes to all classes of taxpayers and to highway financing. (1) Study of highway finance on a state basis in Wisconsin; (2) Study of county highway finances in North Carolina.

Progress in Studies of Mining Methods in the Non-Metallic Industries by the Bureau of Mines*

By J. R. Thoenen
Mining Engineer, U. S. Bureau of Mines

AS SET FORTH in the organic act creating the U. S. Bureau of Mines, its province and duties are to conduct inquiries and scientific and technologic investigations concerning the mining, preparation, treatment and utilization of mineral substances with a view to increasing safety, efficiency, economic development, conservation of resources, and the prevention of waste in the mineral industries, both metallic and non-metallic.

A further duty of the bureau by that act is the publication of the results of such investigations.

During 1930 the work of the mining division under the direction of C. W. Wright was expanded to conduct a more intensive study into the methods of mining employed in the non-metallic industries. In this connection the term "mining" is to be defined in its broad sense, which includes all methods whereby mineral products are procured from their natural source, thereby covering such analagous terms as quarrying, dredging, pumping from wells, etc.

Clearing House for Technical Information

The object aimed at by the non-metallic section of the mining division is to make itself a clearing house for technical information for the non-metallic industries, as is being done so successfully for the metal-mine operators.

The attainment of this objective necessitates the collection and compilation of data concerning all phases of mining and preparation of non-metallic minerals. It follows that one of the first essentials must be the collection and publication of these data in such form as will render it convenient and timely for the use of the operators.

The selection of a mining method should be preceded by a study of the local conditions surrounding the mineral deposit, which may affect the method used, and a study of the application of various types of equipment most suitable to those local conditions. It also involves a study of the comparative efficiency of like methods and equipment under similar conditions or even under dissimilar conditions. It even goes further and involves a study of the effect the selected method of mining may have on the preparation of material for its utilization in a varied market.

In order to study the relative efficiency of various mining methods so that the operator may weigh one against the other in solving his local problems, there must be some medium of interpretation common to all methods.

Media for Interpreting Relative Efficiency

Inasmuch as all mining operations involve the expenditure of money, labor, power, and supplies, there are four such media for interpreting efficiency, namely:

The dollars and cents cost per unit of product;

The man-hour expenditure of labor per unit of product;

The power expenditure per unit of product;

The supply expenditure per unit of product.

Any study of methods must encompass and interpret the local conditions with respect to the common medium of efficiency comparison. Then, and only then, does such a comparison or interpretation become of value.

The object of this section is to study mining methods with due regard to local problems and conditions, and to interpret them by means of one or more of the common media for the benefit of the operator.

Studies of Actual Operations

In this study, therefore, the subject of operating costs becomes secondary. The primary object is the study of methods, and costs enter only as a means of interpreting operating efficiency by the methods used. It might be well to point out further that since the efficiency of any operating step is entirely independent of indirect or overhead costs such as depreciation, depletion, sales expense, etc., these figures are not pertinent to this study, and costs as published in these studies, either in dollars, man-hours, power units, or supply units per ton, can not be interpreted as total costs. They are merely that medium by which the several methods of operation are reduced to a common basis.

In order that this study may be based on a foundation of facts rather than estimates, the ground work must be laid in the data collected from actual operations. Time studies such as have been made in the past, while valuable in showing possibilities under peak production periods, do not present the entire picture. To be of maximum value studies must be made to cover times of low production and climatic suspensions, as well as periods of peak production. To accomplish this the bureau engineers realize fully the necessity of the co-operation of the personnel of the industry itself. For this purpose the following plan has been worked out whereby the personnel of the industry, with the assistance of Bureau of Mines engineers, actively participate in the collection of the basic data.

Through a short questionnaire issued during the past year the bureau has been able to card index about 2000 non-metallic operations with such general information as concerns the material they produce, some data as to local conditions, equipment used, and methods employed.

Two Thousand Operations Card Indexed

From this index selections are made of those operations that are unique in method or equipment or which represent common practice under certain sets of conditions.

These selected operators are requested to prepare detailed technical descriptions of their operations with the requisite supporting interpretation media as to money, labor, power, and supply expenditures. These reports are written by someone on the staff of the operator following an outline furnished by bureau engineers and with the assistance of those engineers.

Comparative Studies

The reports are then edited and published by the bureau over the signature of the author. To accomplish this the author selected by the operator is appointed a consulting engineer to the Bureau of Mines under the rules of the Civil Service, and he is paid for the time so employed at the established rate.

These reports are designed to be complete in detail from the first step in the examination of a deposit by prospecting methods through the development, mining, and treatment stages till the product is properly prepared for market.

The bureau engineers then assemble the data thus made available and sort out from various papers those portions dealing with each operating step. These are combined

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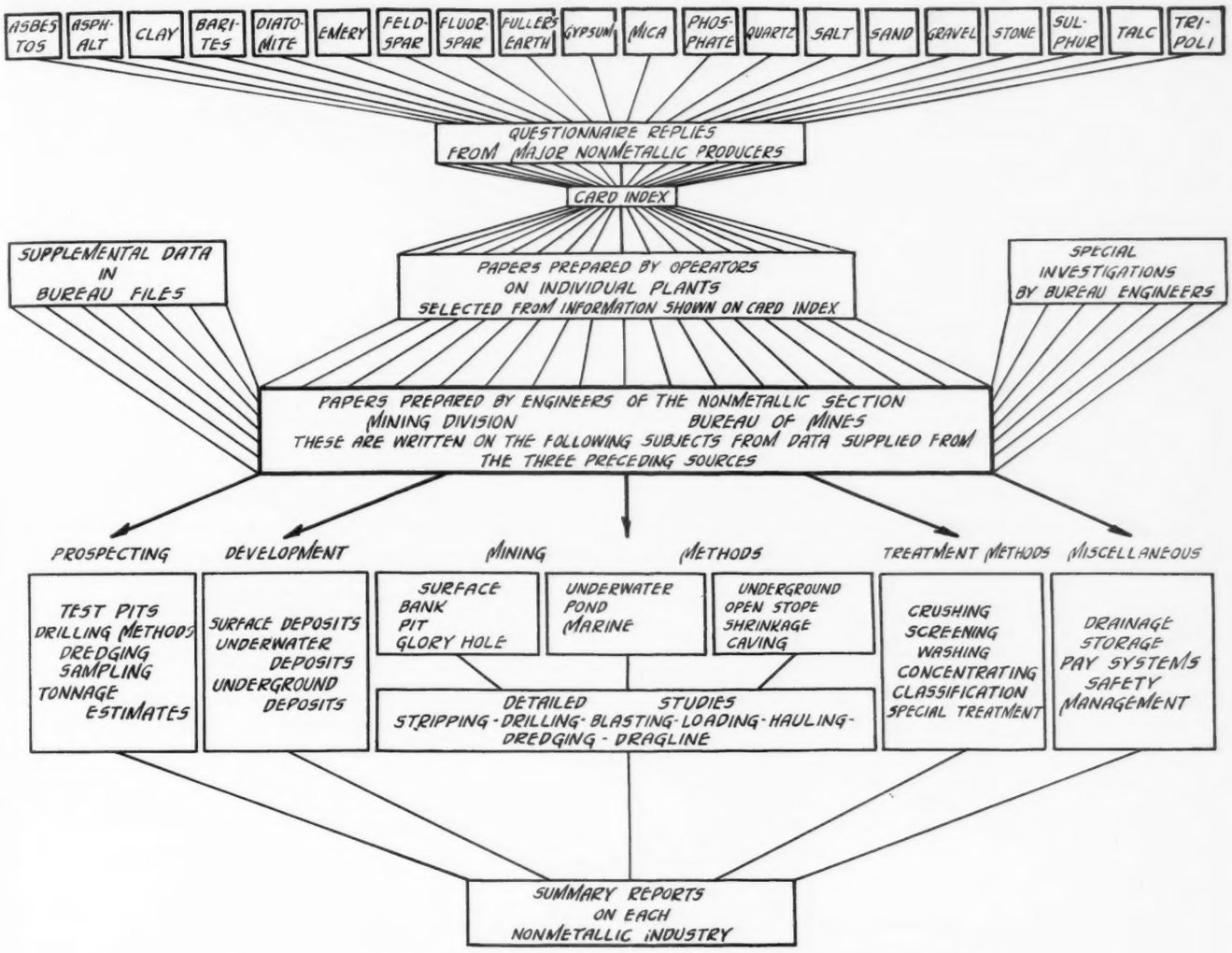


Oragnization plan of the Bureau of Mines in securing data on non-metallic industries

into separate papers wherein the advantages or disadvantages of each method are pointed out and discussed with possible recommendations as to improvement in safety and efficiency or the elimination of waste. Thereby material collected from the experience of many individuals is brought between the covers of one publication, thus forming a technical library of operating details which up to the present time has not been available to the non-metallic operator.

The accompanying organization plan of the non-metallic section will illustrate the variety of subjects to be treated in this manner by the bureau engineers from data supplied in the reports of the operators.

Revision of Data in Five-Year Periods

It is further tentatively planned to keep this library up to date by covering the same ground in five-year periods, thereby recording changes and improvements in methods and practice. At similar intervals, through collaboration with the personnel of the economics branch of the bureau, complete bulletins on the various non-metallic minerals are planned which are designed to present the technologic and economic situation at these stated intervals.

The advantage of having such a technical library constantly at hand cannot but be appreciated by the practical operator. It gives him an insight into the practice of other operators in his same line of business, gives him a technical answer to many questions which are constantly arising in his own business, and provides an authentic source for information regarding a particular operating step with which he may not be familiar but which his changing conditions may demand that he adopt. It also provides a knowledge of the location of plants having similar problems to solve and the method employed in solving them. It sets up certain standards by which he may gage the efficiency of his own operations. In short, it disseminates a knowledge of the technique of his industry at a minimum of cost to himself and his company.

This procedure and plan of operations has been followed among the producers of metallic ores with remarkable success, and operators of metal mines the country over have expressed their appreciation of this work by their co-operation in the preparation and publication of some seventy reports dealing with mining and milling methods in their industry.

Many Reports in Preparation

To date there have been three reports published on mining methods and treatment in the non-metallic field. There are, however, 56 other similar reports in preparation by a staff of forty consulting engineers and the work of assorting data from them for compilation into the special reports by bureau engineers will be started as soon as a sufficient number of these original papers have been received and published.

Naturally in a comprehensive study such as this the greater the number of reports furnished by the personnel of the industry the greater will be the extent and value of the combined and special reports by the bureau engineers. It is therefore hoped that those companies interested in this program will volunteer their co-operation by letter to the director of the Bureau of Mines so that the study may be made as comprehensive as possible.

Research Activities of the Portland Cement Association for 1930

By H. F. Gonnerman
Manager of Research Laboratory, Portland Cement Association, Chicago

IN THE DEVELOPMENT of portland cement and the application of concrete in various fields of construction, new problems are constantly arising which require systematic and accurate investigations to obtain the information necessary for their solution. The manufacturers of portland cement early recognized the need for and advantages of co-ordinated co-operative research and in 1916 inaugurated investigations on concrete and related materials on a comprehensive scale. These investigations have been concerned principally with the development of sound processes for making concrete. As methods were not standardized, much of the early work was devoted to the development of methods of testing concrete and to studies of the fundamental factors affecting strength and other properties which are involved in the design of concrete mixtures.

In contrast with these early studies many of the investigations of the past few years have not been so much concerned with strength and related properties as with basic studies looking toward the development of sound recommendations for the production of economical and durable concrete, and of fundamental information on the constitution and properties of cement itself—the binding agent in concrete. As a consequence, some of these later investigations cover entirely new fields of concrete research and are so extensive in scope that they must necessarily be continued for several months or even years before they may be considered in any way complete.

During 1930 the research activities of the laboratory at Chicago have been confined for the most part to six major investigations, the following brief descriptions of which will serve to give some idea of their purpose, scope and outstanding features:

Permeability Tests of Concrete

The ability to resist the penetration of water is recognized as a particularly desirable characteristic of concrete which is to be used in structures such as dams, tanks, reservoirs and miscellaneous marine structures where the concrete will be subjected to water pressure and to severe conditions of exposure. A review of the literature on permeability of concrete reveals the need for basic information on the influence on watertightness of the various factors known to affect the other properties of concrete.

Studies of the behavior of concrete under various conditions of exposure have also shown a need for fundamental information concerning the effect of watertightness or lack of watertightness on its resistance to disintegrating influences. In order to study these questions on a broad scale, steps were taken early in the summer of 1928 to investigate methods of making permeability tests on concrete which would yield dependable results and permit the carrying out of tests on a large number of specimens simultaneously. After considerable study the type of apparatus shown in Fig. 1 was adopted as most suitable for the tests contemplated. This arrangement will accommodate 6-in. diameter specimens 1- to 4-in. in thickness, which may either be molded separately or cut from standard 6- by 12-in. cylinders.

The degree of watertightness is determined by the amount of water which after passing through the specimen is caught by a glass funnel 4 in. in diameter held against the center portion of the bottom surface of the specimen by means of springs. Water caught by the funnel is discharged into a glass graduate either directly or through a small rubber hose. With the present arrangement 44 individual specimens can be tested at the same time. Pressures usually employed are 80 lb. per sq. in. for specimens 2, 3 and 4 in. thick and 20 lb. per sq. in. for specimens 1 in. thick. Fig. 2 shows a view of some of the apparatus with several units in place. Special apparatus is provided for making tests at pressures up to 250 lb. per sq. in.

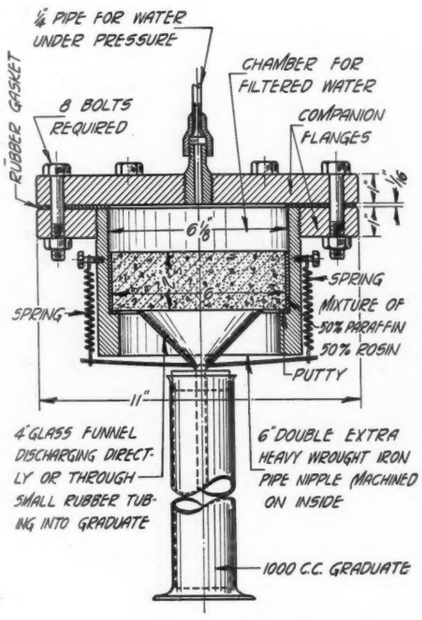


Fig. 1. Apparatus for permeability tests of concrete specimens

Most of the specimens are subjected to water pressure for a period of 72 hr., but in some cases the duration of test has been extended to 7, 14 and 28 days. Results of some of the early tests were presented in the December, 1929, *Journal of the American Concrete Institute* in a paper by F. R. McMillan and Inge Lyse in which the effects of water-cement ratio, duration of moist and air-curing periods, amount of cement paste, duration of test, characteristics of cements, direction of application of pressure and effects of admixtures were discussed.

During the past year tests dealing with the characteristics of cements, the effects of admixtures, water-cement ratio and duration of moist and air-curing were continued and in addition studies were made on type of unit, phenomena of the sealing action of concrete under water pressure, permeability of concrete subjected to alternate freezing and thawing, leakage-strength relations, effect of amount of water pressure, thickness of specimen and methods of molding.

Of the results thus far obtained, the most significant are the marked influence of the water-cement ratio and the method and duration of curing on watertightness. The water-cement ratio has been established as a fundamental factor in the permeability of any concrete mix, very consistent relations having been found for all conditions of test, irrespective of the kind of cement and whether or not the specimens contained admixtures. Next to the water-cement ratio no single factor seems to have as great an effect upon the leakage of concrete or mortar as the duration of the moist curing period. The method and extent of curing was found to have even a greater influence on watertightness than on strength. Through additional moist curing more of the mixing water is brought into combination with the cement, thus building up an internal structure that is more resistant to the passage of water.

Inert admixtures have been found to have little or no effect on watertightness when tested in concrete of a fixed mix and a constant consistency as measured by the slump. In some cases a reduction in watertightness is brought about by the extra water required to produce a given consistency when admixtures are used.

Tests with cements of different characteristics showed that the development of watertightness at early ages was comparable

with the development of compressive strength. Those cements which gained their strength more rapidly during the first few days were found also to gain watertightness more rapidly. However, all the specimens of water-cement ratios of about 7 gal. per sack or less became completely watertight with continued moist curing for periods of 1 to 2 weeks.

In tests on concrete specimens of varying thickness the leakage for a given applied pressure was found to be approximately inversely proportional to the thickness of the specimen. The relation between leakage and pressure for specimens of a given thickness was not rectilinear except at the higher pressures—that is, from 150 to 250 lb. per sq. in. In studying the effect of thickness, the method of placing the concrete was found to have an important influence on the magnitude of the variations in results.

Study of Volume Changes

Shrinkage and expansion of concrete is receiving considerable attention from investigators both in this country and in Europe. Shrinkage is recognized as an important factor in the bond between concrete and steel, in the stress in the reinforcement, in the cracking of walls and slabs, while in floor and road construction shrinkage is a particularly important item, as it influences warping and cracking.

Investigations on shrinkage and expansion of concrete by our research laboratory have been under way for several years. These have dealt with such studies as effect of regaging and remixing, size and shape of specimen, type, fineness and storage of cement, absorptive form, curing, admixtures, quantity of cement, paste ratio, water-cement ratio, type and size of aggregate and loss of water, and have brought out some interesting relationships between the various factors involved.

Observations over a period of several months on mortar and concrete specimens, 5- by 5- by 20-in. in size (Fig. 3), made from sand and gravel aggregates combined in varying ratios of fine to coarse aggregate

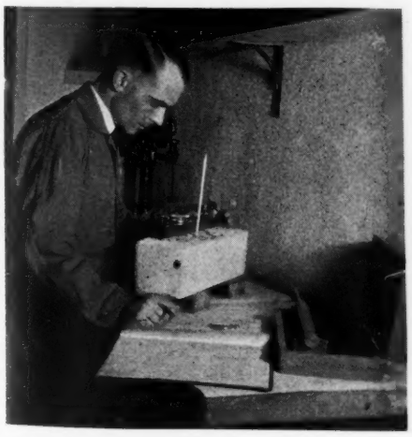


Fig. 3. Measuring shrinkage of concrete specimen with strain gage

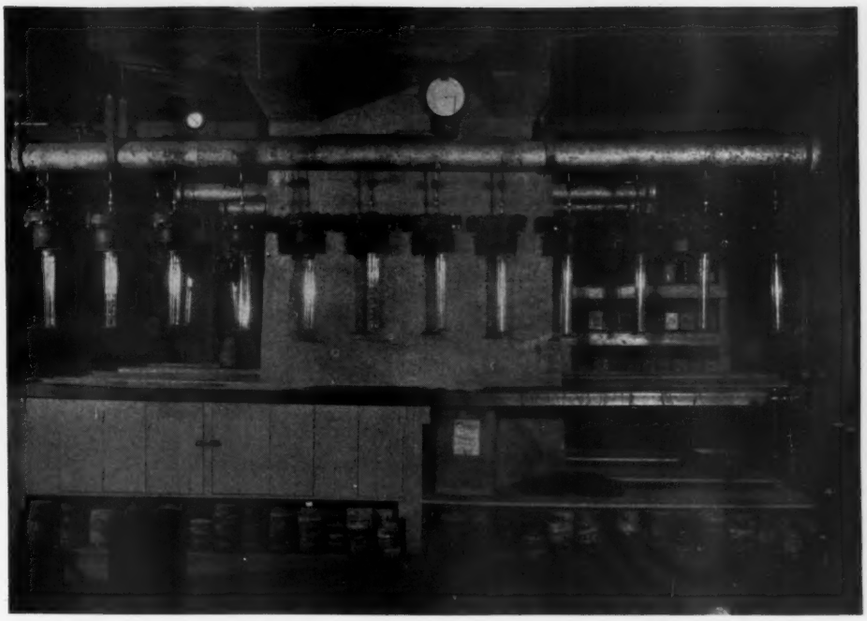


Fig. 2. Portion of permeability apparatus with several units in place

and in which the quantity of cement and the water-cement ratio varied over a wide range indicate that a definite relationship exists between the shrinkage, the loss in water from the specimens and the cement content of the mixture for given storage conditions (7 days' moist curing followed by 6 months' curing in air at 50% relative humidity and a temperature of 70 deg. F.). There is also indicated a definite relationship between the original water-cement ratio of the mixture and the amount of the water lost under the given conditions of test.

These relationships have been found extremely useful in comparing the relative shrinkage of different concrete mixtures, particularly those used in the design of floor finishes and for structures where minimum shrinkage is desired. In order to estimate the probable shrinkage for curing conditions similar to those used in these tests, it is only necessary to know the water-cement ratio and the number of sacks of cement in a cubic yard of concrete.

With the relationships established for a given set of conditions and materials, the investigation is being extended to include differences in curing and type of aggregates. The curing studies include various initial periods in the moist room as well as alternate wetting and drying. The types of aggregates being investigated include blast-furnace slag, cinders, trap rock, limestone, granite and sandstone, as well as gravel. The grading of each of these aggregates, both fine and coarse, was made to correspond exactly to the grading of the sand and gravel used in a previous series of tests to aid in direct comparison of the results.

Fire Resistance of Walls of Concrete Masonry Units

While the excellent fireproofing qualities of portland cement concrete have long been recognized, until about 1921 very few tests had been made to obtain information on the performance of walls constructed of concrete block and tile when subjected to standard fire exposure. In June, 1928, a comprehensive and systematic investigation of the fire-resistant properties of walls of concrete masonry was begun by our laboratory. Suitable equipment for the conduct of standard fire tests was installed together with a block machine and mixer for the manufacture of the units.

The test program has been planned to bring out the influence on fire-resistance of such factors as type and grading of aggregate, cement content, curing, design of unit, type and quantity of mortar, workmanship in laying the walls—that is, character of horizontal and vertical joints, and application of plaster. This work has involved the design and construction of a number of pieces of fire testing equipment so arranged that the wall can be installed in a steel test frame, loaded by means of hydraulic jacks and exposed on one face to the flames of a vertical, gas-fired furnace for fire endurance test. Immediately after exposure to the fire, the test wall can be withdrawn from the furnace and subjected, while fully loaded, to the impact, cooling and eroding action of a standard water stream applied to the incandescent face.

The furnace fire is regulated by a system of manually operated valves with the aid of thermocouples to follow the standard time-temperature curves. Other thermocouples are provided for measuring temperatures at various places within the wall and on the exposed surface. The deflections and changes in dimensions of the wall panels during and after exposure to load, fire and water are measured by sensitive gages. Figs. 4 and 5 show views of some of the equipment and of a number of test panels.

The units for laying up the walls are made in the laboratory with the usual block machine equipment. This makes it possible to obtain the complete history of each variety or condition of unit from the time it is made until the assembled panel is ready for test.

To date fire tests have been conducted on more than 90 wall panels, 5½ by 6 ft. in size, representing approximately two-thirds of the test work scheduled for the investigation. The fire endurance tests are being supplemented by other tests and examinations designed to determine the composition of the materials and obtain data on physical properties such as weight, absorption, compressive strength of the individual units and the relative load-carrying ability of the various wall assemblies before and after fire exposure.

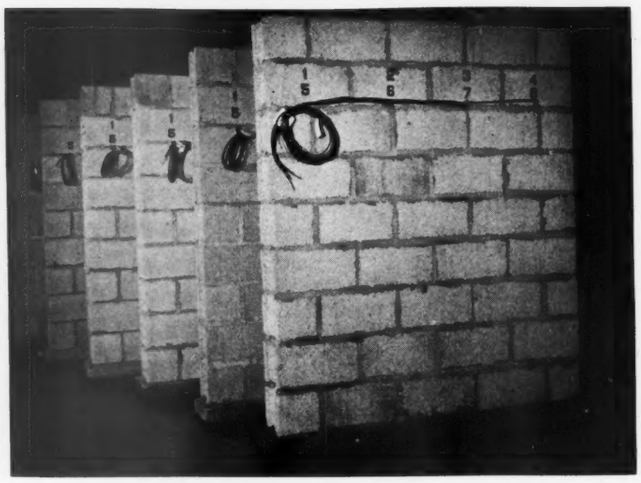


Fig. 4. Several panels curing preparatory to test

The tests thus far made have yielded very interesting and valuable information on the various factors under investigation. Some of these factors have been found to have a very appreciable and definite influence on the fire endurance period, while others have only a relatively small influence and can be varied within wide limits to satisfy local manufacturing conditions at the products plant.

The results of the ultimate load tests conducted in connection with the fire endurance tests have provided strong evidence regarding the stability and safety of concrete masonry walls even after severe fire exposure. In the tests conducted thus far there was no evidence of spalling of the exposed face of any of the test walls either during or after fire exposure in spite of the range in grading of aggregate, cement content, type of aggregate and in the strength, density and design of the units.

While the results of this investigation apply directly to concrete masonry, a considerable amount of information is being developed that will be of great value in the fireproofing of steel with concrete.

Durability Tests of Aggregate for Concrete

Extensive field examinations of concrete structures and highways have disclosed a number of examples of unsatisfactory concrete resulting from failure of the aggregates. These direct evidences of the harmful effects of non-durable aggregates combined with other indications have shown the need for a comprehensive study of the variations in aggregate quality that may be encountered in pits and quarries and the effect of such variations on the durability of concrete in which the aggregates are used. Such an investigation has been under way for more than a year and covers petrographic and geologic studies in the laboratory and field, sodium sulphate tests for soundness and freezing and thawing tests of the aggregates and of concretes and mortars in which the aggregates are used.

An important objective in this study is the development of some physical test by which the suitability of aggregates for use in concrete can be readily and positively determined. It is believed that if the aggregate particles themselves can resist the destructive effects of freezing and thawing and are sound under repeated wetting and drying, they will be durable in concrete under all normal exposures. Soundness tests ordinarily applied to agregates such as tests of sodium sulphate, immersion and drying, and alternate freezing and thawing are being used. In addition, concrete and mortar specimens made from the various aggregates are being subjected to freezing

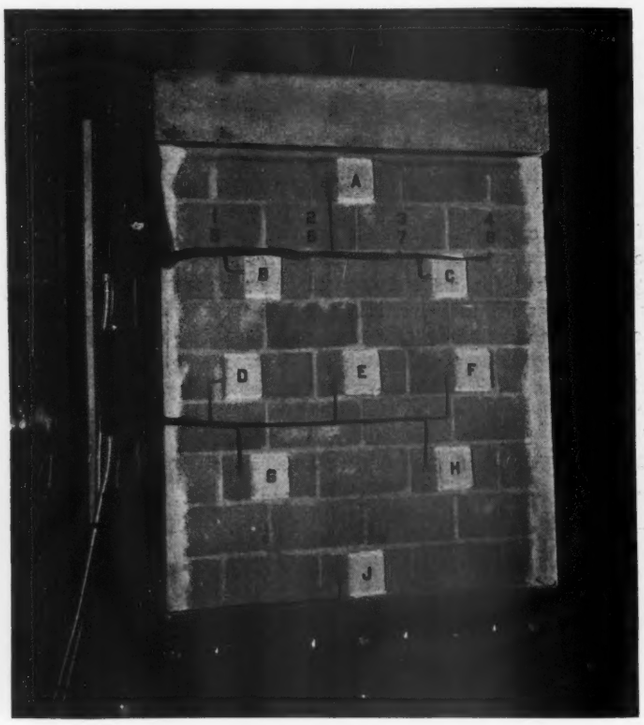


Fig. 5. Masonry panel in place in gas-fired furnace before test

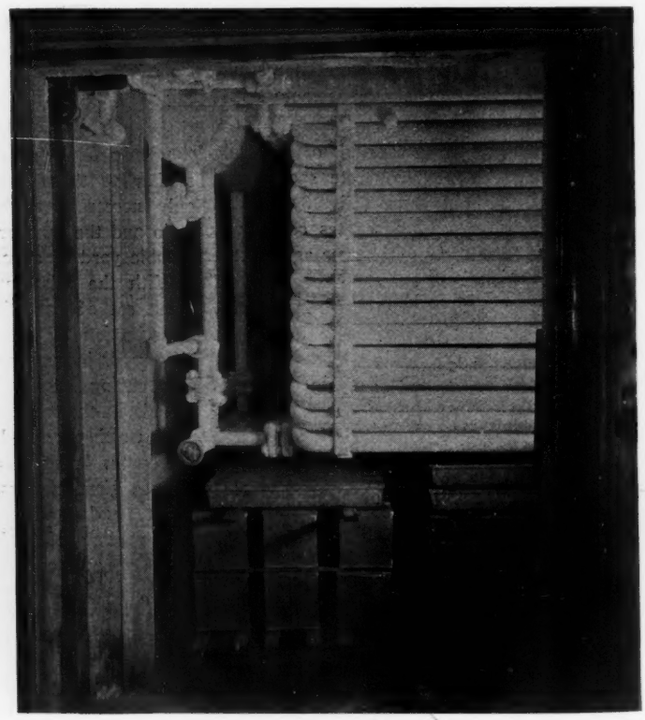


Fig. 6. Mortar and concrete cubes in refrigerator prior to freezing

and thawing with the view to establishing, if possible, the relation between the behavior of the aggregates when tested alone and when tested in concrete.

Although the sodium sulphate test has been in use for several years for determining the soundness of coarse aggregate, some differences of opinion have arisen as to the method of applying the test and interpreting the results. Because of the uncertainty surrounding the use of this test, an extensive study was undertaken of the test itself. From this study a definite procedure was evolved which is believed to overcome the objections that have been raised and which makes possible the duplication of results by different operators with a satisfactory degree of concordance. While no definite correlation has as yet been established between the behavior of aggregates in this test and in structures, it appears that the method is very useful in detecting weaknesses in aggregates which are likely to cause disintegration of concrete when exposed to the ordinary processes of weathering.

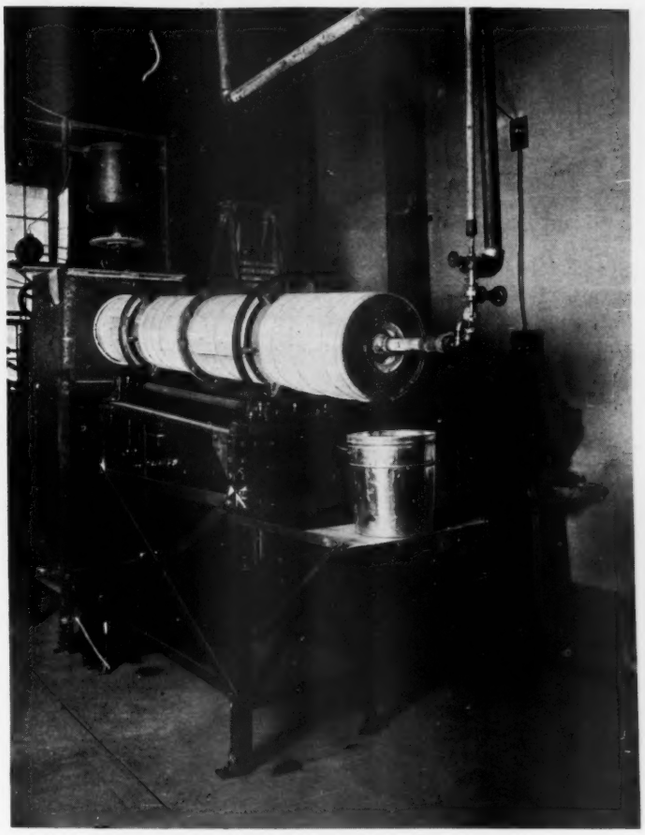


Fig. 7. Experimental gas-fired rotary kiln used by P. C. A. fellowship, Bureau of Standards

Soundness tests are not only being applied to coarse aggregates but also to fine aggregates. Although fine aggregates, because of the size of the particles, call for a somewhat different treatment than is employed with coarse aggregate, soundness tests are being applied to them successfully by sieving a 500- to 1000-g. sample into 5 or 6 sizes. Separate tests are made on the material retained on each sieve and the fine material passing the 100-mesh sieve is studied under the microscope. The percentage of unsound material in the total sample is determined from the weighted percentages of particles of each sieve size that has failed.

Since the final test of an aggregate's durability is the durability of the product made from it, the aggregates are made into mortar or concrete cubes which after a period of combined moist and air curing are at age of 28 days alternately frozen and thawed. In the tests under way the fine aggregate is made into 2-in. mortar cubes using 4 different water contents ranging from a very rich mix containing 4½ gal. water per sack of cement to a lean mix containing 9 gal. per sack. An examination of the cubes is made at the conclusion of every 5 cycles; and when they first show evidences of breaking down and at later periods, their strength is determined and compared with the strength of control specimens of similar composition that have been stored in the moist room. Coarse aggregates are made into 6-in. concrete cubes using mixtures containing 5½, 7 and 9 gal. per sack and given the same treatment as the mortar cubes.

The refrigeration apparatus available for this work made it possible to give 4 to 5 cycles of freezing and thawing per week to approximately 1500 mortar specimens and 100 samples of fine and coarse aggregate. In addition, approximately one ton of concrete cubes and cylinders received the same number of cycles as a part of other studies on durability of concrete. Fig. 6 shows some of the specimens in the refrigerator prior to freezing.

For this investigation about 150 samples have been collected, taken largely to represent the poorer materials. Many of the samples were materials that were suspected of being responsible, at least in part, for unsatisfactory results. Although the tests are not yet completed they have provided some valuable and interesting information. A study of the behavior of the mortar cubes shows a very definite relationship to exist between the resistance to freezing and thawing and the water-cement ratio each of the sands showing a definite maximum permissible water-cement ratio for a given degree of resistance. This maximum permissible water-ratio has afforded a useful basis of classifying the various sands and of bringing out their individual limitations. A comparison of the petrological analysis of the sands with their behavior in the mortar cubes indicated that the presence of more than about 3% of shale would result in a mortar of relatively poor resistance to freezing and thawing.

Another important fact brought out by the data was that the grading of many of these suspected sands was unsatisfactory for concrete, especially when used in fixed proportions. Many of them were so fine that the amount of water required for even relatively rich mixes resulted in water-cement ratios sufficiently high to account for the disintegration by freezing and thawing. Some of the structurally sound sands had water requirements so high as to place them among the very worst sands so far as producing quality concrete was concerned. On the other hand, some of the sands whose gradings would indicate that they should produce durable mortar, actually produced an inferior mortar because of the structural unsoundness of the particles.

Durability Tests of Concrete

Studies on the behavior of concrete to repeated freezing at temperatures likely to be encountered in the field have been continued and several groups of freezing and thawing tests are under way with a view to obtaining information on the fundamental factors affecting durability of concrete so that definite rules may be laid down for the production of concrete that will be durable even in the severest climates. In one of these groups of tests completed during the past year, comparison was made of the resistance to freezing and thawing, the compressive strength, porosity and permeability of specimens of varying cement and water content.

In the freezing and thawing tests two types of specimens, 6 by 12-in. cylinders and 6-in. cubes, were used. The cylinders were cast individually but the cubes were cut from beams cast on end and on side in order to determine the effect of segregation of mixing water and aggregates during placing. An outstanding result of these tests was the important effect of the water content of the mix on its resistance to freezing and thawing, there being a material decrease in such resistance with increase in the water-cement ratio for mixes otherwise identical. The coarse aggregate seemed also to have an important influence as mortar specimens showed a greater resistance than concrete of the same water-cement ratio.

Survey of Structures in Service

A nation-wide survey of concrete structures in service, begun in 1928, has been essentially completed. This survey of struc-

tures parallels a similar survey of concrete roads which has been under way for the past few years by the Highways and Municipal Bureau of the Association. In this survey the behavior of a variety of concrete structures was investigated over a wide range of climatic exposures which covered practically the entire range of temperature and humidity, and combinations of the two, likely to be encountered. Over 650 structures in the United States and Canada were examined, attention being given almost exclusively to outdoor structures and particularly those in direct contact with water.

An unusual opportunity was presented in this survey for studying as a single problem the performance of concrete over a wide variety of conditions. The number of structures examined and the variety of conditions included are so large that a general picture of concrete performance was obtained which would not have been possible from the study of only a few structures.

The outstanding observations in this field survey can be briefly summarized as follows: The principal destructive agents are the repeated freezing and thawing of saturated, porous concrete and the solvent action of water which finds its way through the concrete mass. The effect of climatic conditions was quite evident. Concrete of a quality that showed rapid deterioration in the northern climates was totally unaffected after years of service in regions free from severe frost action. Of equal significance was the observation that deterioration due to percolating water or frost was almost wholly confined to joints, honeycombed spots, laitance seams, and other defective points resulting from improper manipulation.

Almost without exception the defective concrete observed was not due to chemical disintegration resulting from the composition of the cement, but was the result of these physical forces on the areas of weak porous concrete. Even where the deterioration was most severe, very large proportions of the exposed areas remain unaffected, showing the suitability of the materials to produce durable concrete when construction defects are eliminated.

Researches on Cement

Definite progress has been made during the year on the research program of the Portland Cement Association fellowship at the National Bureau of Standards, Washington. The investigations of this fellowship, which are under the general supervision of P. H. Bates, chief, Clay and Silicate Products Division of the Bureau, and in the immediate charge of Dr. R. H. Bogue, director of the fellowship, are designed to explore the major chemical problems of the cement industry.

The following investigations constituted the major activities of the fellowship during the past year: (1) A study, with pure materials, of the influence of composition on the volume constancy of specimens of the set cements; (2) A comprehensive study of the set of cements which includes research on (a), the chemical phenomenon of set; (b), the influence of rate of set on the properties of the cement; (c) the measurement of rate of set; and (d), the control of set; (3) A fundamental investigation on the kinetics and thermodynamics of the hydration or setting process; (4) Phase equilibria study of the cement systems; (5) The development of the X-ray method for the study of the constitution of portland cement.

An important investigation was completed during the year which involved studies of the relative merits of different processes of raw grinding (producing mixtures of different size distribution) on the economy of operation, the burnability of the mixtures and the qualities of the cements. The cements in this investigation were burned in an experimental rotary kiln (see Fig. 7) which permits the production of about 10 lb. of cement clinker per hour under controlled conditions. This kiln is now being used to produce cements of a wide range in composition from commercial raw materials in a recently inaugurated systematic study of the effect of composition on the concrete-making properties of cement. In this latter study, in addition to the usual cement tests, volume change studies are being made and the cements are made into concrete for strength tests and exposure to weather, freezing and thawing and to salt solutions.

Publications of the Fellowship during the past year were as follows:

Paper No. 21—"Calculation of Compounds in Portland Cement," by R. H. Bogue, *Ind. Eng. Chem.* (Analytical Edition, **1**, (1929), 192; Rock Products **32**, No. 23 (1929), p. 47.

Paper No. 22—"The Influence of Magnesia, Ferric Oxide and Soda upon the Temperature of Liquid Formation in Certain Portland Cement Mixtures," by W. C. Hansen. *Bureau of Standards J. of Research*, Jan., 1930, Research Paper No. 132.

Paper No. 23—"Revised Procedure for the Determination of Uncombined Lime in Portland Cement," by Wm. Lerch and R. H. Bogue. *Ind. Eng. Chem.* (Analytical Edition) **2** (1930), 296; *Concrete*, **37**, (1930), 88.

Paper No. 24—"The X-ray Method Applied to a Study of the Constitution of Portland Cement," by L. T. Brownmiller and R. H. Bogue. *Bureau of Standards J. of Research*, October (1930) R. P. No. 233, *Am. J. Sci.* (in press).

Co-operative Researches on Concrete

The Association has co-operated in a number of important research projects carried out at other laboratories. One of these co-operative investigations was a series of beam tests made at Lehigh University in co-operation with the university to establish the relation between the stress developed in a beam at failure and the ultimate strength of the concrete when tested in the standard 6- by 12-in. cylinder. The data from these tests were published in a paper by W. A. Slater and I. Lyse on "Compressive Strength of Concrete in Flexure as Determined from Tests of Reinforced Concrete Beams," which appeared in the *Journal of the American Concrete Institute* for June, 1930.

The most extensive research project in which co-operation was afforded is that on reinforced-concrete columns under way at Lehigh University and at the University of Illinois under the auspices of the American Concrete Institute. The test program includes a total of more than 675 plain and reinforced concrete columns. Progress reports on this investigation are to be presented at the annual convention of the American Concrete Institute in February.

Educational Activities Along a Number of Lines

The dissemination of information obtained from our researches and those of other laboratories on the basic principles of good concrete and quality control methods has continued to form an important activity of the laboratory. Over 30 courses in concrete mixtures were given by members of the laboratory staff in various cities throughout the country.

On July 14, 15, and 17 members of the staff participated in the Summer School for civil engineering teachers conducted by the Society for the Promotion of Engineering Education at New Haven, Conn. This school was sponsored by the Society for the Promotion of Engineering Education, Yale University, the American Society of Civil Engineers, the Highway Research Board, and the Association.

These educational activities have been found to be extremely helpful in promoting a better understanding of the fundamental principles of concrete making on the part of the organizations and individuals directly affected. They also afford an opportunity of bringing to the immediate attention of those interested the latest findings of concrete research and improvements in concreting equipment and practice, and thus encourage and stimulate improvement in concreting methods generally throughout the entire country.

A. S. T. M. Book of Standards for 1930

THE American Society for Testing Materials, 1315 Spruce street, Philadelphia, Penn., has issued the 1930 Book of Standards. This book is published in two parts, Part I covering methods, and Part II nonmetallic minerals. The volume comprising Part II contains 251 standards of which 248 relate specifically to nonmetallic minerals and three standards of a general nature applying to both metals and non-metals.

The Book of Standards is issued triennially and the next edition will be in 1933.

Those standards which are adopted by the society in the intervening years are published in supplements to the book.

State Highway Departments' Materials Engineers Report on Research

NO SUMMARY of research on cement and aggregates would be really complete without reference to the work being done by the various state highway department laboratories. Moreover, producers of cement and aggregate want to know not only what the highway departments are doing, that may affect the specifications for their materials, but what phases of research, and what problems in the use of cement, concrete and aggregates are interesting the largest users the most.

Through a very generous response to a letter addressed to the materials engineers or the testing engineers of the various state highway departments we are able to give here a very fair summary. Among the questions we asked these engineers were: What phase or character of research in aggregates are you engaged in?—most interested in? Do you consider the new A. S. T. M. specifications for portland cement and high-early-strength cement adequate and satisfactory? If not, wherein are they lacking? How are you dealing with segregation of aggregates? Is the research done by the three national associations of aggregate producers, stone, gravel and slag, helpful to you? Do you find it competitive, one with the other? What suggestions have you to make regarding such work?

Arizona

Arizona's highway system consists mostly of graveled roads with concrete drainage structures. The material for this work is usually taken from deposits near the scene of construction, there being plenty of sand and gravel in the state, but with the small plants used it is difficult to get a uniform and high grade material. This lack of uniformity necessitates designing a separate mix for each deposit and hence what research work is done is testing of such materials and designing the mix accordingly. As washing the gravel is often out of the question, cleaning gravel by means of blowers is often done with some success.

Development of Low Cost Surfaces

As the state has a limited budget and an enormous area to cover, the research work has also been directed towards the development of a low cost road and the highway department has adopted a construction system based somewhat on the systems used in Oregon and California for roads of this type. The essential details of its construction are as follows:

The subgrade is tested for stability, and if found to be sufficiently stable to support a non-rigid pavement, material is placed on the road to a depth of 4½ in. and 20 ft. wide. If, however, the subgrade is found to be unstable, 4 in. of sand, gravel and clay of a suitable nature is placed as a subgrade stabilizer. On top of this is the paving material to a depth of 4½ in. This material, if ideal, consists of approximately 45% rock, uniformly graded from 1-in. to ¼-in.; 50% sand uniformly graded from ¼-in. to 200-mesh, and 5% passing the 200-mesh screen. To this is added about 1¾ gal. per sq. yd. of asphaltic base oil, containing 65 to 75% of 80 deg. penetration asphalt. This is thoroughly mixed to a uniform color by disking and turning with motor graders, and after spreading, rolled with an 8-ton roller. The cost of processing the material after it is placed on the road is said to be about $2000 per mile, including the cost of the oil.

During the first year of this type of construction certain difficulties were encountered, for instance, certain oiled roads would be depleted causing the roadbed to ravel and go to pieces. This was overcome by selecting a type of asphaltic material that would not emulsify when it became wet and devising means of determining such types of asphalt before they were used.

Specifications—Segregation

Arizona highway officials consider the A. S. T. M. specifications for cement satisfactory and an improvement over the old specifications. They do not use high-early-strength cements and hence have no comments to make on such cements.

The highway department is not spending a great amount of effort on segregation except to exercise reasonable care at the plants to prevent segregation in the bins.

California

The Division of Highways of California is conducting tests to determine what influence surface characteristics of aggregates have upon portland cement and asphaltic concrete pavements. It is hoped to determine the relative suitability or quality of materials in terms of surface characteristics, shape of particles, inherent stability, etc. Correlating existing tests and devising others which will furnish information to fill the gaps is also requiring considerable work.

Segregation Problems Taken Care of By Design

Studies of segregation have developed some new conceptions of control practice and design of proportions. Since, as it is stated, changes in grading do not affect yield when weight proportioning is used, the importance of this factor in concrete making is open for discussion. (For further comments on this statement as to grading and its effect on yield see August 16, 1930, issue of Rock Products, "Promotion of Premium Aggregates," by Stanley M. Hands, junior testing engineer.)

The problem of designing proportions which will compensate for changes in grading due to segregation has been given serious consideration by the California research staff and when this problem was correlated with problems of inherent characteristics of aggregates there developed very practical reasons for believing that too much emphasis has been placed on the sizing of aggregates, according to their summary of results.

This leads them to believe that it is more desirable for the proportions to fit the materials than it is to fit the sizes and that the best grading for combined materials differs somewhat with the surface characteristics of the materials.

Cement Specifications

The changes in the A. S. T. M. cement specifications are being investigated in California, but cement mills in that territory, it is stated, manufacture a cement well above these specification requirements.

High-early-strength cements have some value, it is said, but other factors than strength have operated to prevent the full utilization of this feature.

Connecticut

During the past two seasons the engineers of the Connecticut Highway Department secured a more uniform concrete and better workability through study of these problems. They believe the next step forward will be the batching of coarse aggregate in separate sizes.

While evidencing a desire to conduct research work, they were unable to do so on account of constructing a new addition to their laboratory.

Delaware

While not engaged in any research work of its own, the Delaware State Highway Department is interested in research to develop the relation between the per cent. wear under the standard tests of coarse aggregate and the actual service in concrete roadway which that aggregate will give. The present tensile strength test on fine aggregate does not seem to bear a relation to the various strengths secured when that fine aggregate is used in concrete. Various adaptations of compression tests, beam tests, etc., have

been used to test fine aggregate, but the engineers are interested in researches that would lead to definite standards being adopted for aggregate materials.

Some difficulty was experienced in Delaware with segregation of aggregates under the new specifications which require a relatively large percentage of the whole between the ¼-in. and ¾-in. sizes. This difficulty was offset by using baffles while loading the cars and by requiring stockpiles to be built in 4-ft. layers.

Cement Specifications

Specifications for portland cement and high-early-strength cement are adequate for the time being, but standard tests on both classes of cements could be greatly improved, in the opinion of Delaware officials. Present tests are lacking because of the difficulties of one laboratory checking with another and from the fact that tensile strength results are not a true indication of the compressive and modulus of rupture strengths secured in actual concrete.

Florida

The State Road Department of Florida is conducting work on fine aggregates to note, if any, the detrimental effect of using fine sands in concrete (30% or more of this material passing a 50-mesh screen). No work is being done on coarse aggregates. They are, however, interested in the seriousness of the detrimental effects of using a coarse aggregate that has a high (8 to 12%) percentage of wear; and if a limestone having a specific gravity of 2.50 to 2.55 and percentage of wear from 4 to 10% could be used with satisfactory results in Class AA concrete (4000 lb. per sq. in. in 28 days) in the building of structures in or adjacent to sea water.

Florida's maximum sized material is 1½-in. and hence segregation is not a serious factor, although stockpiles are formed in layers and over as large an area as possible.

Georgia

The State Highway Board of Georgia began a study of concrete aggregates with the idea of establishing the concrete strengths (both compressive and transverse) to be expected from different types where the cement factors and water cement ratios remained constant. This work is not completed.

A study of the merits of the different types of aggregates for surface treatment work was begun, as it was deemed the abrasion test alone is not adequate. The highway department is now using a roller test for indications of an aggregate's adaptability for surface treatment on penetration macadam construction. The test is made as follows: A 30-lb. sample is screened over the minimum screen specified (a ¼-in. screen in case of ¾-in. to ¼-in. aggregate) and spread upon a metal lined runway 13 in. by 10 ft. A hand roller, 12 in. wide, weighing 600 lb., is passed over the aggregate at a definite rate 20 times (or 10 round trips). The aggregate is then rescreened through the same screen and the difference in weight reported as per cent. loss. From this test it was found that some aggregates having a high percentage of wear as determined in the Duval abrasion test have a low percentage as determined in the roller test and vice versa.

Seek the Methods of Making Densest Concrete

Further study of the relation of density of concrete to its strength in support of a method of design based briefly on the following is contemplated:

(1) Strength of concrete is proportional to density.

(2) The densest concrete is made of aggregates having the lowest voids.

(3) Where a certain definite strength is sought, the ratio of cement to sand by volume should be constant, as strength of concrete is regulated by ratio of cement to sand.

(4) A certain definite amount of surplus mortar should be provided in all mixtures to enable proper workability. This surplus mortar factor will vary slightly, depending upon the types of aggregate. Thus, rounded gravel does not require as much surplus mortar for workability as slag. The surplus mortar factor is that percentage of sand by volume above the amount necessary to fill voids in the coarse aggregate. It is found that the following surplus sand factor is about correct; gravel, 0.14; stone, 0.15; slag, 0.16.

For example, 1 bag of cement to 2 cu. ft. (dry rodded) of sand is constant. With a gravel of 40% voids the ratio of sand to the gravel would be 2 to $\frac{2}{0.40 + 0.14}$ and the mixture becomes by volume 1-2-3.7. A table is furnished showing the corresponding mixtures by weight of volume of aggregates of various specific gravities and voids. Later when data and tests are completed this theory is hoped to be proved or disproved.

The Georgia state highway officials consider cement specifications adequate. They are in favor of shipping aggregates in separate sizes to prevent segregation.

Idaho

The Department of Public Works of the state of Idaho uses mostly gravel and hence its interest lies principally in this type of material.

Such research work as has been undertaken by the Department of Public Works, though in a small way, deals with a study of the interrelation of the four standard test gradings for gravel abrasion tests and also the interrelation of abrasion tests of crushed and uncrushed gravel. This is developing some useful material.

Illinois

During the past year the Department of Public Works and Buildings of the state of Illinois concentrated most of its investigational work on the question of proportioning concrete. During the year the mortar-void method of proportioning was adopted and also actual proportioning in the field by the weight method was put into effect. This necessitated a considerable volume of research work along those lines.

The A. S. T. M. specifications for portland cement and for high-early-strength cements are satisfactory.

Indiana

The Indiana State Highway Commission continues to carry on research work but prefers to wait until it is completed before making any comments. Officers do feel, however, that in the field of research of concrete aggregates the matter of soundness is still probably the outstanding problem for crushed stone. They state that some very excellent work has been done by Dr. H. F. Kriege (France Stone Co.), Stoddard, of Iowa, Scholer, of Kansas, and others, and that it appears from this work that the soundness test can be improved and better defined.

Another possible advance is an abrasion test which can be made on the manufactured product rather than upon quarry samples.

Problem of Soft Pieces in Coarse Aggregate

The most prominent problem in connection with gravel aggregates is probably the matter of soft material. They found that clean gravel later becomes so coated by the time it is used that the change is almost unbelievable. This coating appears to be due to the soft particles being abraded by the harder particles; and the surface moisture in the gravel acting as a vehicle coats all of the pebbles. The extent of this coating appears to be a function of the type and amount of soft material, the amount of moisture present and the number of times the aggregate is handled. They also believe this coating is different from the same quantity of like material occurring as an admixture. A study should be made of the effect of such coating and a method devised for measuring the amount.

Overcoming Segregation

They have attempted to overcome segregation by requiring the stockpiles to be built up in 3-ft. layers, but this provision is hard to enforce, and they suggest the use of coarse aggregate delivered in more than one size. A study of this has led them to wonder if it would not be feasible to consider all the aggregate in the mix and still use only two sizes which might be classified as fine and coarse, but to make the separation point possibly on the ½- or ¾-in. sizes rather than the ¼-in., as is now common practice.

Such a procedure, they believe, would permit the use of more fine gravel and might result in more balanced production of sizes from a stone plant with relation to its market demand.

Specifications for High-Early-Strength Cements Need Amplification

It seems to be generally agreed that the use of high-early-strength cement is so general that there should be a standard specification available to prevent a large variety of specifications coming into use, and that the present A. S. T. M. tentative standard is probably as good as can be prepared in the light of our present knowledge, say the Indiana highway officials. It appears that the tolerance allowed on the fineness of grinding is entirely out of step with the cements appearing on the market. The normal consistency test for determining the amount of water to be used in other tests is generally agreed not adequate for the finely ground cements. Also it has become apparent that the storage of samples of fine ground cement and control of temperatures during test are extremely important, as such cement is very susceptible to even slight changes and the temperature range allowed in the present specifications is probably too great for satisfactory testing. There is a question of whether or not the 200-mesh sieve is suitable for measuring the fineness of cements which are being produced for high-early-strength work. The present trend appears to be a development of a high-early-strength portland cement, but it seems reasonable to believe that there are possibilities of a satisfactory and economic high-early-strength cement being developed which is not truly a portland cement and an investigation might be conducted along this line.

Iowa

The Iowa State Highway Commission is very much interested in the problem of identifying unsound particles in coarse aggregate, particulary in some means of distinguishing between particles that will be likely to cause pits and those which will be likely to cause spalls in concrete. Some unsound particles seem to disintegrate without any change in volume. These will probably result in a pit in the surface of the concrete when they are covered by only a thin coating of mortar. They will probably cause no trouble other than a slight reduction of the strength of the concrete when they are buried in concrete to any considerable depth. Particles of soft ochre are typical of this kind of particles.

The Problem of Unsound Particles in Aggregates

In the case of some other kinds of unsound particles, disintegration is accompanied by a change in volume. Such particles are likely to cause spalls even though they are embedded in the concrete to some considerable depth. The spalls are conical in shape with the unsound particle at the apex of the cone. Therefore, the pit in the surface of the concrete is larger than the particle which caused it. Some kinds of shale and some kinds of chert are typical of the kind of particles that cause spalls.

The solution of the problem may be quite simple if it involves the rejection of the entire output from a given source. It is quite complicated when it must be applied to routine testing of definite units of material having varying percentages of various kinds of particles that seem objectionable. To arrive at a definition for each kind of objectionable particle that can be interpreted by the inspector in the field seems to be quite difficult.

Effect of Type of Aggregate on Expansion of Pavement Slabs

In connection with a study of the effect of variations in methods of curing concrete paving slabs, they made up 14 slabs each 2 ft. wide, 6 in. thick and about 80 ft. long. In seven of these one kind of coarse aggregate was used; in the other seven a different kind of coarse aggregate was used. It is observed that this difference in coarse aggregate caused a considerable difference in the change in length of slab for a given change in the temperature of the concrete. An attempt is being made to find the cause of this difference in results.

Study of Practicability of the Design of Concrete Mixtures

If the study of the design of concrete mixtures is research work on aggregates, they say that they have been studying Dr. Talbot's theory of the design of concrete mixtures for four or five years. They have designed two mixtures on this theory and have used these mixtures with great success. They hope to be able to find a way to make a more general application of such designed mixtures, and believe they can handle the technical part of the problem, but there are some difficulties in the administration of specifications calling for such designed mixtures on work let on competitive bids for the job complete. They feel that under this system of letting contracts the engineer is under obligation to furnish the contractor with data for accurately estimating the quantities of material required for a unit volume of concrete. They have found no way to furnish such data for designed mixtures that is not quite clumsy when applied to jobs where material from a number of sources is available.

It so happens that in Iowa the economical concrete mixture is an "over-sanded" mixture. Therefore, the grading of the coarse aggregate may vary within rather wide limits without causing any serious results. Therefore they take no special pains to avoid the segregation of coarse aggregate other than to see that the material goes into railway cars well mixed and to see that stockpiles are built up in horizontal layers.

Kentucky

Perhaps the most outstanding work of the Kentucky State Highway Department has been the use of local sandstone for both coarse and fine aggregates in concrete pavement.

The next important work was the use of local material in concrete structures. By proper mixing and control the officers of the department have succeeded in making satisfactory concrete with low grade sandstone, limestone, creek gravel and sand. In many places shipped-in material would have cost four or five times as much as the local material. A great deal of money was saved in this way, it is said.

During the year they worked out a new specification for concrete pavement and structures, which they believe to be equal to that of any state. It is based on a minimum cement factor, maximum water with slump control, and allows the use of practically all commercial aggregates. This new specification has been found to be very satisfactory.

A Comprehensive Research Program

The following is a list of subjects which were studied during the past year: (*a*) The relationship between the moisture content in concrete and its strength. (*b*) Haydite as an aggregate for concrete and its use in concrete bridge floors. (*c*) How the relationship between the fine and coarse aggregate affects the strength of concrete. (*d*) The relationship between the strength and the time of placing concrete in the forms. (*e*) A study of the characteristics of rock asphalt. (*f*) The relationship of the various tests on bituminous materials. (*g*) High-early-strength cements. (*h*) Relationship of strength of concrete to end condition of cylinders and capping. (*i*) Determinations of moisture content in fine and coarse aggregates. (*j*) Comparative strength of concrete pavement when cured with (1) wet earth 7 days, (2) wet straw 7 days, (3) wet burlap 48 to 36 hours. Present indications are that the 36-48 hour burlap will give just as satisfactory results as either the straw, earth or any other method of curing that they have tried.

Shrinkage or hair cracks have been studied and a successful method of prevention proposed. Excessive cracking in the concrete slab is being studied and they expect to be able to explain the causes and offer a method of prevention.

This year they expect to give attention to changes in volume, shrinkage, its cause and prevention, unusual cracking in structures, the causes, with proposed methods of correction. This work will likely be done in co-operation with the United States Bureau of Public Roads. They also expect to work on the sodium sulphate test for soundness. They believe this test is very indefinite at present and needs to be revised so that it may be performed in a more definite way.

Segregation

The specifications provide for storage in such a way as to prevent segregation. When segregation does occur the operator is required to manipulate the loader in such a way that the aggregate is remixed. As a whole, the problem is not serious within the state.

Maine

Following are some of the projects being undertaken at the University of Maine, Technology Experiment Station, maintained co-operatively by the University of Maine and the State Highway Commission.

Project 760. Highway Materials Survey. This project is an extensive survey of the road materials of the state of Maine, and is a co-operative project between the Maine State Highway Commission, the Coe Research Fund Committee and the Maine Technology Experiment Station. Its object is to secure as definite information as possible concerning the location, character, suitability and quantity of deposits of sand, gravel and rock. These deposits will be shown on sectional maps, and complete information will be given as to availability and condition of haul in each case.

It is hoped that this survey will be useful to the state highway engineers, to contractors for road and bridge construction, local builders and manufacturers and owners of quarries and pits or banks of sand and gravel. One of the benefits to be derived from the project will be information concerning the availability of good concrete or highway materials, which in turn will mean a material saving in estimating the exact length of haul to any particular project so that more accurate cost estimates can be made. The suitability of local materials for certain types of construction will help to decide the most economical design to use in every case.

It is believed that the findings of this survey will have considerable geological value. At the completion of the field work a complete report will be compiled and published by the Maine Technology Experiment Station.

Project No. 232. A study of hydrogen-ion content of Maine sands.

Project No. 233. A study of long time strength tests of sand mortars.

Project No. 237. Prediction of 28-day tensile strength of sand mortars from 1-day information. This bulletin will give a summary of the work which has been carried on at the station for the last ten years.

Maryland

The State Roads Commission of Maryland constructed 4½ miles of experimental road to investigate the relative properties of 14 different types of road material to be used as resurfacing over worn-out concrete roads. Portland cement concrete and 13 different bituminous materials were used in this section. The commission also constructed a 1¾-mile experimental road studying the effect of transverse joints and various types of joints in concrete pavement construction. It is expected to publish detailed reports on these investigations later.

Michigan

The question of soundness of aggregate occupies the attention of the Michigan State Highway Laboratory and its engineers hope for the development of a test which will enable them to forecast correctly the behavior of aggregates in surfaces from the standpoint of soundness.

In connection with gravel aggregates, they are interested in the elimination of soft particles which occur in the deposits—generally of soft sandstones, shales, ochre, etc.

As the state uses a large volume of aggregates, particularly gravel, they are interested in all phases of aggregate researches.

Shipping Aggregates in Separate Sizes Successful

Since they have adopted methods of close control of their concrete mixtures, the elimination of segregation is regarded as being even more important than formerly. Despite all that can be done a quite marked degree of segregation occurs in the 2¼-in. coarse aggregate which is used in concrete pavement. In consequence they are very much interested in the use of coarse aggregate shipped in two sizes, proportioned individually by weight in the batching of the mixture. They have not specified that aggregates be shipped in two sizes thus far, but they tried this method in comparison with a combined aggregate on a long project during the latter part of last summer. This scheme worked out very well and the contractor, as well as the highway department, was well satisfied.

Missouri

The Missouri State Highway Department has recently completed the installation of a three-compartment freezing unit in its laboratory and it is the intention to start a rather extensive investigation and study of the effect of alternating freezing and thawing on aggregates and on the resulting concrete. However, to make such tests more significant the testing engineers are interested in seeing developed a more definite relationship between such tests and actual field conditions as a means of more accurately predicting the economic use of different available combinations of aggregates.

Subsoil Treatment

They are endeavoring to keep the average total cost per mile of farm-to-market roads at $5000 or under. This has forced them into an intensive study of the treatment and stabilization of soils and subgrades. Since fine materials can be purchased at a lower cost, they have constructed a number of experimental projects utilizing different combinations of crusher run stone, chats and screenings with and without dust, sand, pea gravel, and different percentages of sand in gravel. Other materials and modifications of treatment will be used but they are intensely interested in seeking that gradation or combination of aggregates which may produce the greatest stability in a given soil consistent with such low type construction.

They are also interested in the development of the so-called intermediate type of construction consisting of suitable surface treatment on a stabilized subgrade. Most of the stone encountered in the state is rather soft, it having a French coefficient of near 5 to 7, and breaks up badly on rolling. From results obtained in their initial efforts in retread construction they feel that this type of construction has much merit but they have had difficulty in securing aggregates free from fine material. This is due to insufficient screening equipment at the producing plants and to the inherent softness of the aggregate. They have one experimental retread project in which gravel crushed to 1¼-in. (circular opening) was used. This is showing promise for this type of construction. Consequently they are interested in any phase of aggregate research in connection with this type of work.

Precaution Necessary in Testing High-Early-Strength Cements

They consider the new A.S.T.M. specifications for portland cement quite satisfactory and adequate. However, because of the great susceptibility to temperature changes and to exposures of a fresh sample of high-early-strength cement they consider it necessary to provide for a narrower temperature range in the moist closet and greater protection by sealing a small fresh sample of such cement in transporting to the laboratory in order to avoid misleading results on tensile properties. Since the high-early-strength cements are ground to a high degree of fineness a somewhat smaller addition of water is necessary than is ordinarily indicated by the normal consistency test as now used in order to give the proper plasticity or workability for making the mortar. They have found that if an amount of water is used as indicated by the regular normal consistency test, lower tensile strength will be obtained whereas suitable plasticity or workability and higher strength can be obtained by the use of lesser amounts of water. This is entirely consistent with the water-cement ratio theory and they believe a modificaton of the normal consistency test is desirable.

Nebraska

A study is being made by the Department of Public Works of oiled sand surfaces where various types of road oils and cut-back asphalts are used. During the past season a ten-mile section of experimental oil sand-road was constructed under the supervision of the Federal Bureau of Roads.

Characteristics of different asphaltic oils are being investigated.

The state continued the pavement crack survey and much interesting information is being obtained. A correlation of compressive strength of concrete cylinders and cores, including field transverse strengths is also under way. Variations of concrete design, including the testing of both beams and cylinders is being studied experimentally.

Nevada

The State Department of Highways of Nevada has been accumulating and digesting data to justify a general conclusion that the three-day tests, using ordinary portland cement, is not a good index to the strength quality of a sand. This is especially true of a sand whose tensile strength, as determined by the 28-day test, hovers near the specified minimum. In general there is no correlation between 3-day and 28-day or even 3-day and 7-day tension tests.

The research department has also done some experimental work with "Lumnite" cement as a laboratory cement for the quick testing of sand tensile strengths. By its use results can be obtained in 24 hours that are reasonably accurate whereas using the ordinary portland cement similar results would require 28 days.

The testing engineers are further interested in the water-cement ratio phase of concrete production and believe that good concrete lies in the adjustment of this ratio rather than in the adjustments between cement and the aggregate.

New Hampshire

The New Hampshire State Highway Department believes one of the most important problems that should be studied by a research laboratory of a highway department is the question of subgrades. In northern climates frost action is a problem compelling attention to the various types of soils and the behavior of each. To this end officials have established a soils division with an engineer in charge. On all work they are having soil profiles made, which in addition to the centerline profile established by the division engineer, furnishes not only a picture of conditions on top of the ground, but conditions from three to four feet underneath. While this work of necessity calls for considerable labor and expense, the results obtained justify the expenditure. There is no doubt that many foundations have been over designed. A soil profile will eliminate this with a saving of much money. This saving can be applied to sections of the road which really need more intensive treatments.

Foundation Problems Most Important

They find that concrete troubles happen at points where cuts and fills meet. It is their opinion that when a better knowledge of what takes place in concrete after it is placed is added to the information that will be obtained from these soil studies, much better and more durable concrete structures will result. They are also interested in the question of the behavior of aggregates when mixed with cement and water, laying special stress on the problem of workability. Workability, in their opinion, is a very loosely used word.

Too Much Emphasis on High-Early-Strength

New Hampshire's engineers believe too much emphasis and attention is being placed on high-early-strength cements. They say, as presumably we build a concrete structure to last over a period of years, it does seem that a few days more spent while construction is in progress might be of considerable value to the concrete after a period of years. In other words, we seem to be in a great hurry trying to get nowhere. They were very sorry to see the A.S.T.M. change the specification, for it has been their experience that cements with high-early-strength do not give as high a strength after a long time as those which harden more slowly. The argument that pavements must be opened up in twenty-four hours so as not to interfere with the public, does not seem like a sound basis of reasoning to them.

This state is at present trying to determine just what happens when concrete is placed. There appears to be a movement of the coarse aggregate in a vertical line and it is this point that they are trying to determine quantitatively.

New Jersey

The New Jersey State Highway commission's specifications so classify and define the fine and coarse aggregates which are available in the state for concrete construction that its engineers can predict in advance about what to expect when certain materials are used in the manner required. They have, for some time, been paying particular attention to the grading and the character of the aggregates and the method of proportioning these materials for use in concrete, as judged by the difference in the workability of concrete produced from these variations in aggregates. They have also studied the strength of the concrete as it is affected by this workability and particularly so in regard to the brand of cement used, for apparently different brands of cement produce concrete mixtures varying greatly in workability and strength, even when the same aggregates are used.

Cement Specifications Not Satisfactory

They do not consider the new A.S.T.M. specifications for portland cement and high-early-strength cement entirely adequate and satisfactory and find when cements are classified entirely by the strength of briquettes, or compression specimens made of a standard sand mortar, that these tests are not a criterion of the strength to be developed in concrete where identical fine and coarse aggregates are used. At present they have not prepared a specification covering a new type of cement desired, but believe that it should have some reference to the flour content.

Ship Aggregates in Two Sizes

To provide for possible segregation problems, they have divided coarse aggregate into two sizes to reduce segregation and are specifying three bin weighing batchers.

New Mexico

While the State Highway Department of New Mexico does not maintain a research laboratory its engineers are interested in the effect of surface characteristics of aggregate on compressive strength. They have found that all things being equal as near as can be made, water-cement ratio included, that they get more strength out of rough surfaces than rounded pebbles. This, they expected but are interested in a method of more definitely forecasting the results when such materials are used. They further believe that most concrete failures are bond failures induced by compression.

North Dakota

The North Dakota State Highway Department completed a series of interesting compression tests, the purpose of which was to determine how large a percentage of shale or soft rock of the type found in North Dakota could be safely used without a decided loss in strength. The type of soft rock used was dark brown in color and when first examined would give the impression of being a solid rock. However, if this rock is exposed to the weather a short time it will first check and an outer shell will come off similar to a nut exposing a soft internal kernel. In some instances the kernel is hard.

The results indicate that somewhere between 2 and 4% of this soft material can be used without lowering the compressive strengths. In fact an increase in strength can be expected, judging from the results. Apparently the soft material acts as an absorbent and reduces the water-cement ratio.

On the tests using shale it was found that up to 4% shale could be used without decreasing compressive strength but it was not advisable to use such material except where the pavement or concrete structure would not be subjected to weathering as the effect of shale on the weathering of concrete was not determined. The series of tests will be published complete in Rock Products.

Ohio

The following investigations have been definitely scheduled at the Ohio State Highway Testing Laboratory for the winter of 1930-31:

Project No. 1—An investigation to find

out more about the relation, if any, between the abrasion loss of gravel, crushed limestone, and crushed slag, as determined by the modified abrasion test and the concrete-making properties of these three aggregates as shown by the standard beam test and the standard compression test. Six gravels, six crushed limestones and six crushed slags have been secured for this investigation, which is already under way. In each group of six aggregates, there is as wide as possible a range in abrasion loss. However, each individual aggregate is uniform in its abrasion loss as well as in other characteristics. The grading of each aggregate is their standard No. 34 as follows:

Passing 2- in. (circular openings).....100%
Passing 1½-in. (circular openings)..... 90%
Passing ¾-in. (circular openings)..... 35%
Passing ¼-in. (circular openings)..... 5%

In order that this investigation might be made in accordance with the existing specifications of the Ohio State Highway Department, the concrete is being proportioned to have a cement factor of 6.3 sacks of cement per cubic yard of concrete, which is the minimum cement factor permitted in portland cement concrete pavement. The same water-cement ratio is being used in proportioning the concrete made with all six aggregates in the same group. There is, of course, a different water-cement ratio for each of the three kinds of coarse aggregate. The same brand of portland cement and the same concrete sand is being used throughout the investigation. Twenty-four 6-in. by 12-in. cylinders and eight 6-in. by 6-in. by 40-in. beams are being made with each aggregate for tests at 7, 14 and 28 days. The concrete is mixed in batches sufficiently large to make three cylinders and one beam. All test specimens are stored in the laboratory's moist room where humidity and temperature are kept standard.

It is expected to have this investigation completed by March 15, 1931.

Project No. 2—An investigation to determine the concrete strengths obtained with so-called high-early-strength cements. Five such brands of cement are now available in Ohio. The standard sand mortar briquette tests are to be made at the following ages: 1, 2, 3, 5, 7, 14 and 28 days.

Sufficient 6-in. by 12-in. cylinders and 6-in. by 6-in. by 40-in. beams are to be made using the same coarse aggregate, fine aggregate and water-cement ratio, with each of the five brands of cement. At least three cylinders and three breaks from the standard beam are to be made from each brand of cement at each of the following ages: 1, 2, 3, 5, 7, 14 and 28 days.

Every possible effort is being made to have all factors constant except the brands of high-early-strength cement.

Project No. 3—An investigation of the density of sheet asphalt mixes. This investigation is to determine whether the density of sheet asphalt samples prepared and compressed in the laboratory is comparable with the same mix after it is rolled the usual amount in the construction of sheet asphalt pavements; also to determine if it is possible to compress sheet asphalt of various gradings (sand, filler and bitumen) covered by the Ohio State Highway Department specification, to 96% of the theoretical density; also to determine the increase of density of various new sheet asphalt pavements after they have been under traffic. The procedure to be followed in this investigation is not covered by this report, but a sufficient number of specimens will be studied to warrant a worthwhile conclusion.

Project No. 4—An investigation to determine the effect on mortar strength and on concrete strength of material passing a 200-mesh sieve in limestone sand. It is intended to use limestone sands meeting the present requirements for concrete sand of the Ohio State Highway specifications, with the exception that the amount of material passing a 200-mesh sieve is to be varied as follows: 1%, 2%, 3%, 4%, 5%, 10% and 15%.

A sufficient number of standard 1-3 briquettes will be made and broken at 3, 7, 14 and 28 days to warrant a conclusion as to the effect of material passing a 200-mesh sieve on mortar strength. Then it is intended to make a sufficient number of 6-in. by 12-in. cylinders and 6-in. by 6-in. by 40-in. beams to warrant conclusions as to the effect of fine material on compressive strength of concrete and on the beam strength at the ages mentioned previously.

Oregon

The Oregon State Highway Commission is working on a method of determining the original water-cement ratio of set concrete. They have their field engineers send the laboratory a sample of the mortar taken direct from the mixer and cast in a rectangular form. The sample, after hardening, is sent to the laboratory where the work of determining the W/C is in progress. The length of time after hardening makes no difference. The engineers in charge of the work hope to have the method proven or disproven within the next few months.

Pennsylvania

The Department of Highways of Pennsylvania is right now most interested in soundness tests. Its research laboratory finds research on soundness, fine and coarse aggregates, is probably being carried on to a greater extent today than any other kind of research on these materials. Many investigations are being made of the use of the sodium sulphate test. This test has not been standardized and the conditions for running the test and the number of cycles in sodium sulphate must be solved before any final steps can be taken toward the standardizing of this test. In regard to the freezing and thawing test, the duration of cycles is still an open question and the quickness of freezing is probably a large subject for consideration, *i. e.*, whether it is advisable to allow, for a period of about 10 hours, for the reduction of the temperature from 70 to 0 or minus, or to accomplish this within one or two hours.

In regard to segregation it seems to the Pennsylvania engineers that the only solution of the problem is to ship in separate sizes. Coning in the stockpiles is prevented by insisting on materials being stock-piled in layers of not over 4 ft. in thickness.

The A.S.T.M. specifications for portland cement, according to the Pennsylvania Highway Department, while not fully adequate and satisfactory represent the best knowledge that we have of such at the present time. To date no satisfactory suggestions have been made as to the relative value of tests for free lime and other chemical tests on cement. In regard to high-early-strength cement the engineers feel that the 100-lb. gain in tensile strength is rather severe especially from the standpoint that the required gain in normal cement from 7 to 28 days is only 75 lb. Also consideration has been given to other matters which might be considered in this higher strength cement specification, for instance, longer mixing time, to take care of the finer grinding and methods of regulating the water other than the normal consistency tests.

Rhode Island

It is refreshing to note that the State Board of Public Roads of Rhode Island, as a measure for relief of unemployment, has had several men from other departments alloted to its personnel thus expediting researches. Investigations are under way on the behavior of specially treated sub-grades during frost action and for the making of soil profiles at several points that are known to heave badly. The engineers also started a culvert survey that is expected to yield some interesting data. The board expects to co-operate with the Committee of the American Association of State Highway Officials during the winter for a trial of proposed methods involving the use of constant-water-cement ratio for evaluating various sands. They have been running so-called wet mixes (in both cubes and beams) abreast of specified tensile tests in order to obtain information as to the limits within which their ordinary concrete sands fall. It is hoped that this information combined with the record of strength of the concrete made will give them a basis to work on in the future, providing they change their test requirements. They are also watching the quality of their gravels as gaged by the various abrasion tests in order to obtain information regarding the proper limits to insert in specifications covering the use of these materials.

The state does not have a special research department and such work of that nature as is done is sandwiched in with the routine work of the board.

No Trouble With Segregation

Rhode Island engineers have had little trouble with segregation of aggregates on account of using the entire output of local crushers producing crushed and washed gravel and sand exclusively for its various contracts. The average grading has been well within the limits specified, and it has not been necessary to require measurement of more than one size of coarse aggregate to date.

The State Board of Public Roads has not had sufficient experience with the new portland cement specifications to state whether or not they will improve concrete but it has had very satisfactory results with the older cements that did not have very high 7-day strengths but gained considerably between the 7-day and the 28-day period. The engineers state that this gain in strength is conspicuously absent in the newer cements.

Tennessee

Research by the Department of Highways and Public Works of the State of Tennessee has been with respect to the quality and gradation of aggregates on the resultant concrete in which the aggregate is incorporated. Compression and beam tests are conducted on 28-day specimens in this work.

The testing engineers are also endeavoring to determine if limestone and crushed gravel with over 50% crushed particles is a better aggregate from a standpoint of strength and quality of the concrete than gravel aggregates having rounded particles. Also, the bureau is endeavoring to determine the necessity of having specifications requiring straight-line gradation of the aggregate, in view of the economy involved in securing aggregate under such a rigid specification.

In regard to the problem of segregation, it is stated that materials used within the state are inspected at origin and all material loaded into cars must be thoroughly mixed. Segregation is prevented during unloading as far as possible by prohibiting coning of the stockpiles and requiring that the material be deposited in layers not over 2 ft. thick.

The Tennessee highway materials engineers believe the new A.S.T.M. specifications of portland cement are adequate and satisfactory. They have used very little high-early-strength cement.

Washington

The Washington Highway Department has found that a close examination of the surface characteristics of coarse aggregate will frequently indicate that it will produce concrete of poor strength. This applies particularly to gravels and the strength reduction may be as much as 30%. An extremely smooth surface may be caused by water polishing, the gravel may be of a character that produces a greasy texture or it may carry a stain that cannot be removed by washing. These characteristics usually mean a lowering of concrete strength and the reduction in flexural strength is often twice that in compressive strength. A careful visual examination will thus indicate the need for concrete tests of an aggregate which might otherwise be accepted without question.

The testing engineers are interested in a better soundness test for aggregates and a test for particles sufficiently hard to pass the Douglas test but too soft to be accepted.

They are batching their coarse aggregate in two sizes, from ¼-in. to 1½-in. and 1½-in. to 3-in. and this has resulted in great improvement in batch to batch uniformity.

Cement Specifications Not Satisfactory

They are not satisfied with the A.S.T.M. strength requirements for either portland or high-early-strength cements. A low briquette test probably indicates an exceptionally weak portland cement, but it does not properly differentiate between the concrete-making strengths of average cements, and these may vary widely. They consider the briquette test as entirely inadequate for high-early-strength cements and have found some excellent high-early-strength cements that would not pass the A.S.T.M. tensile requirements. On the other hand some portland cements producing concrete of no more than average early strengths give briquette strengths entirely too close to the high-early-strength requirements. It is quite probable that slightly careless testing might classify such a cement as in the high-early-strength group or that a manufacturer might slightly improve his product to meet the tensile requirements without producing a cement of sufficient compressive strength to make it truly a high-early-strength cement.

Needed Tests for Cement

Other needed tests for cement are: (1) a method of determining consistency that is in line with the differences found between cements when they are made into concrete; (2) a method of detecting that property of cement that causes concrete to stiffen badly immediately after mixing although not producing a true set; such cement is very difficult to place and finish, and they have never been able to detect this characteristic in the laboratory; (3) a method of determining resistance of cements to alkaline sulphates without waiting for actual exposure tests.

They further state that a study and explanation is needed of the difference in cement that causes more free water to rise to the surface with concrete made from one cement than with another. This is regularly noticed in pavements made with the same aggregates and poured with the same consistency. Certain brands of cement give up large quantities of water some of which can be removed with a roller and this undoubtedly results in a stronger concrete. On the other hand the time for finishing is delayed too long in the winter months when the days are short. There is also danger of promoting scaling by finishing too early.

Wisconsin

The Wisconsin Highway Commission in 1930 was engaged in one particularly interesting phase of research connected with the use of concrete aggregate in separate sizes. They built several jobs and required that the coarse aggregate be delivered on the job in two or three separate sizes. A large number of tests on this work has convinced them that more uniform concrete can be obtained by proportioning the aggregate by weight from separate stockpiles and that 1931 specifications will provide this requirement. The engineers are doing research work in co-operation with the Bureau of Public Roads and the University of Wisconsin.

Fineness of Cements Should Receive More Attention

The Wisconsin Highway engineers believe that the cement specifications are satisfactory for the time being, but that the ultimate with respect to strengths of ordinary portland cement has not been reached. They believe that fineness of both types of cements can receive more attention and that the mills in their section could easily reach a specification for ordinary portland cement wherein the percentage of residue on a 200-mesh sieve would be considerably less than 22%. The tentative specifications for high-early-strength cement call for the same fineness. They believe that the high-early-strength qualities of such cements are due partly at least to the fineness of grinding and that when sufficient data are available some such fineness requirements should be incorporated in the specifications and as soon as possible.

They call attention to the necessity of accurate temperature control, especially at the time of making tests, and that in the specifications the exact temperature, with tolerances of tests, should be made. Also, that care be exercised in the storing and handling of these types of cements as their extreme fineness makes them susceptible to moisture.

Ship Coarse Aggregate in Two Sizes

Wisconsin specifications cover two sizes of aggregates—one size calling for a 1½-in. maximum size, and the other a 2½-in. maximum size. When the former size is required, it is their practice to separate into two portions—one portion graded from ¼-in. to ¾-in. and the other from ¾-in. to 1½-in. When the 2½-in. maximum size is used they separate the same way and have a third portion graded from 1½-in. to 2½-in. When concrete was made from such separate sizes no segregation was noticeable.

(*Additional data from state reports on following page*)

What Others Think of the National Research Organizations

The abstract of reports from the highway departments herein given are from communications from California, Delaware. Florida, Georgia, Illinois, Indiana, Michigan, Missouri, Kentucky, Iowa, Rhode Island, Wisconsin, Tennessee, and Pennsylvania, but for obvious reasons we are keeping the individual state's identity unrevealed. The other states, in response to our request for information, made no reference in their letters whatsoever to the national aggregate organizations.

State No. 1—It was indicated that the national associations could be more careful in maintaining their mailing lists so that data they did develop could be had by the highway departments without their having to write each time a request for such data. Otherwise the Department believes that the research work of the three national associations is very helpful and is very seldom competitive.

State No. 2—Believes that producer association research work has been competitive until recently and they further are not impressed with so-called research reports that were inspired by gain by individuals or firms conducting such research.

State No. 3—Believes the research work of the national associations to be very helpful and thinks it should by all means be continued. It is not competitive to the point that would destroy its value and it further believes these organizations should be at liberty to carry on research work along lines not directly applying to their product but on materials which might be used with their product.

State No. 4—Indicates that the research conducted by the three national associations is very helpful with some subtle competition. The competition amuses rather than offends.

State No. 5—Considers the research work being done by the three national associations to be slightly biased and that each one is inclined to favor its own products slightly.

State No. 6—Commends the work very highly and wishes it to be continued as it is of great value to both producer and users of aggregates.

State No. 7—Finds the research work of the aggregate associations interesting and valuable; does not think that it is possible for research work to be competitive, especially with men of such standing as are at the head of the technical divisions of the three associations. The present status of research in the field of aggregates impresses it as being extremely fragmentary at present, and it is more often than not, impossible to get a complete answer to any question that may arise. It is further felt that the associations are doing their best to clarify the confused aspect of the situation, and should be regarded as a highly constructive factor.

State No. 8—Believes that the research work being done by the three national associations is very helpful and a further means of stimulating thought and research. They believe that while some duplication of research is probably done that such duplication tends to confirm results. The producer can better afford to look to these national research agencies for guidance than to individuals.

State No. 9—Indicates that it sometimes seems that there may be a duplication of effort by the three national aggregate associations. It might seem that it would be better to have Messrs. Love, Walker and Goldbeck all working together in one labratory. However, duplication of effort is not always objectionable in research work. Perhaps good men do better work when they work independently. Perhaps they are competitive, one with the other, in some details but not in fundamentals. Perhaps competition stimulates the researches and three organizations accomplish more than a single consolidated organization would accomplish.

State No. 10—Says that the research work done by the national associations of aggregate producers of stone, gravel and slag is of considerable help. However, it finds it often competitive and this, in a measure, has a tendency to discount the results shown. This condition is usually true for any material where test results are used in advertising literature and for this reason it cannot be freely accepted as representing the facts. It seems that the facts representing materials can best be worked out by some outside agency, such as the National Research Council, the Materials Committee, the American Association of State Highway Officials, and the American Concrete Institute.

State No. 11—Believes that the three national research associations are doing a helpful work and that they have carried out their work sticking to the facts and that it would be but natural for one group to favor its own products but, so far, the results have been honest and the comparisons valuable.

State No. 12—Finds the work of the three associations helpful, but as slag is little used in that state the work of the National Slag Association is only of passing interest; but that if the research work has been competitive, close following of the work has not revealed such competition. Naturally they bend every effort to obtain results that will be satisfactory to the producers, but as a whole the work is in the hands of men of high caliber and their results are received with interest.

State No. 13—Believes that the research work of the associations is helpful as they deal wth inherent properties of the materials, the work undertaken is not competitive, and that co-operative researches by the various highway departments should be stimulated.

State No. 14—Believes, contrary to most, that the research work done by the three national associations of aggregate producers, stone, gravel and slag, has not been found to be particularly beneficial to its work, and believes that this research work is somewhat competitive, but as it is not particularly interested, has no further suggestions to offer.

State No. 15—Indicates that the work of the three national associations is slightly competitive and it is hard to see how it could be otherwise. Others, especially research workers, appreciate this fact and take it into consideration when forming their own opinions. It is thought that these three organizations can work out problems and present them to the various consumer research organizations for confirmation. It is believed, however, if the competitive aspect of such research work becomes too obvious it is going to lose the respect of most consumers.

Acknowledgments

This publication wishes to acknowledge and thank all the various State Highway Departments for their helpful suggestions and due to the fact that several individuals did not care to be quoted, we have refrained from all and any quotations and also the mentioning of any individual names, much as we would prefer to do so.

Taijiro Asano Succeeds Father as Head of Cement Company

AT A SPECIAL GENERAL MEETING, recently held, of the Asano Portland Cement Co., Japan, Taijiro Asano, eldest son of the late Soichiro Asano, was elected president of the company to succeed his father. Ryozo Asano, the second son, was elected vice-president.

Taijiro Asano is taking his father's place in all the great enterprises of the Asano family, which are continuing as before. Both sons have been frequent visitors in the United States, and are said to have obtained a part of their education here.

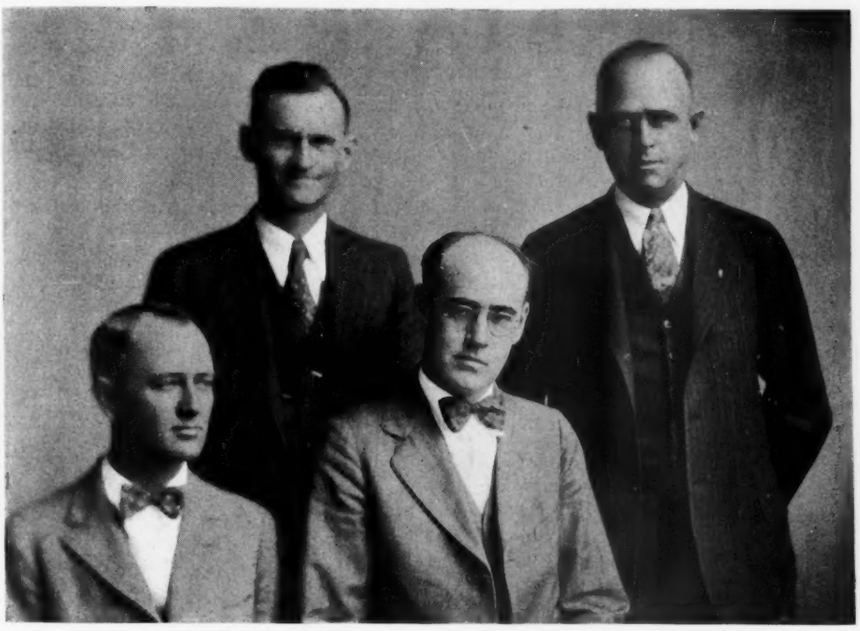
Canadian Phosphate Plant Starts

THE SUPERPHOSPHATE and dry mixing plants of the Canadian Industries, Ltd., Beloeil, Quebec, each with an annual capacity of about 25,000 tons, were formally opened the first week in November. The officers of the company from the head offices of the company in Montreal entertained a large number of governmental officials, including the members of the provincial legislature and the Department of Agriculture of Quebec. Following the meeting those in charge of the various sections conducted the visitors on a tour through the plants.

Texas Crushed Stone, Sand and Gravel Association

Producers of Aggregates Work Together in One Organization Recently Founded at Austin

By W. W. Carson, Jr., Secretary



W. W. Carson, Jr. *E. Eikel* *W. A. Wansley* *W. E. Sampson*

"TO PROMOTE and extend the use of the products of the industry; to provide an organization for the co-operation of its members and the co-ordination of their efforts in all matters pertaining to the industry; to establish and maintain business practices of the highest standard." With the foregoing quotation from its constitution as a declaration of purposes, the Texas Crushed Stone, Sand and Gravel Association was formally launched at a final organization meeting held in Austin, Texas, Saturday, November 29, 1930.

Officers of the new association are as follows: President, W. E. Sampson, Texas Construction Materials Co., Houston, formerly president Texas Sand and Gravel Producers Association; vice-president, E. Eikel, Dittlinger Lime Co., New Braunfels, formerly president Southwest Division of the National Crushed Stone Association; secretary-treasurer, W. A. Wansley, W. D. Haden Co., Houston and Galveston, formerly secretary-treasurer, Texas Sand and Gravel Producers Association.

The above named officers, together with the members listed below form the Board of Directors: Max Altgelt, New Braunfels Limestone Co., New Braunfels; R. J. Hill, Gifford-Hill & Co., Dallas; J. P. Lively, Jacksboro Stone Products Co., Jacksboro; T. E. Popplewell, Ft. Worth Sand and Gravel Co., Ft. Worth. W. W. Carson, Jr., of Austin was elected executive-engineer by the board of directors.

Consolidation Considered for Some Months

The newly perfected organization marks the consummation of plans under consideration for several months for consolidating the Southwest Crushed Stone Association and the Texas Sand and Gravel Producers Association. The entire membership of the two existing associations, so far as canvassed, went into the new organization, and all the assets, records and data of the two associations were turned over to the new board of directors. Necessary incorporation was had by a properly revised charter filed with the Secretary of State of Texas.

The Southwest Division of the National Crushed Stone Association was organized in April, 1926. R. J. Hank, former state highway engineer of Texas, acted as executive-secretary for several years, resigning several months ago to again accept a position with the highway department. The association was well officered and successfully carried on such activities as properly belonged to it.

The Texas Sand and Gravel Producers Association was organized August 1, 1927, duly incorporated under the laws of the State of Texas. In addition to the routine work incident to such an association, it has successfully established a credit bureau and a uniform sales contract and discount policy.

At several times in the past, the two associations have found it necessary to create joint committees for handling important problems common to the entire industry. A notable example was the Southwest freight rate case under the so-called Hoch-Smith resolution of Congress. Another was the proposed taxation of natural resources, and finally during the past year, the complete revision of aggregate specifications by the State Highway Department of Texas. It gradually became quite obvious to the membership of each association that their problems are nearly all common to both industries—in fact that there is really only one industry instead of two. Furthermore some companies are producing both materials. They saw that the troubles of the stone man differed little from the troubles of the gravel man—no more than the troubles at two gravel plants, or two stone plants, may differ from each other. They also recognized that many questions can be handled only by united action. Having reached these conclusions, considerations of efficiency and economy plainly dictated the consolidation, and it was perfected with entire harmony throughout the whole group.

Permanent Headquarters

The Texas Crushed Stone, Sand and Gravel Association maintains permanent headquarters at 601-603 Littlefield Building, Austin, Tex. There are a few producers eligible for membership not represented at the organization meeting who will no doubt come in. When the canvass is completed it is believed that all producers of any considerable size will become active members, thus embracing the entire membership of both the old associations.

The present membership, which represents about 97,000 tons daily capacity, is as follows:

Dallas Washed and Screened Gravel Co., Dallas.
Dittlinger Limestone Co., New Braunfels.
East Texas Sand and Gravel Co., Dallas.
Fort Worth Sand and Gravel Co., Fort Worth.
Gifford-Hill and Co., Inc., Dallas.
W. D. Haden Co., Galveston.
Hillsdale Gravel Co., Sweetwater.
Horton and Horton, Houston.
Geo. R. Humlong and Sons, San Angelo.
Jacksboro Stone Products Co., Jacksboro.
Midland Sand and Gravel Co., Terrell.
More and Moore Sand and Gravel Co., Chillicothe.
New Braunfels Limestone Co., New Braunfels.
Potts-Moore Gravel Co., Waco.
Saxet Sand and Gravel Co., Houston.
Southwest Stone Co., Dallas.
Texas Construction Material Co., Houston.
Texas Sand and Gravel Co., Waco.
Urbana Sand and Gravel Co., Urbana.
Western Sand and Gravel Co., Amarillo.

Researches on the Rotary Kiln in Cement Manufacture*

Part XI—Calculation of the Quantity of Gases of Combustion and Air Quantities Required to Make 1 Lb. of Clinker

By Geoffrey Martin

D.Sc. (London and Bristol), Ph.D., F.I.C., F.C.S., M. Inst. Chem. Eng., M. Inst. Struct. Eng., M. Soc. Pub. Analysts, F. Inst. Fuels; Chemical Engineer and Consultant; Former Director of Research of the British Portland Cement Research Association; Author of "Chemical Engineering"

THERE IS a very considerable uniformity of composition of the gaseous products of combustion evolved in the making of portland cement clinker.

For this purpose we will compare the products of combustion evolved by burning equivalent quantities of two coals—one of 12,710 B.t.u. per lb. and the other of 11,851 B.t.u. per lb.

Products of Combustion from a Coal of 12,710 B.t.u. per 1 Lb. Compared to Products of Combustion from Standard Coal

The coal in the Works Test, No. 26, had the following composition:

	Dried	As fired
C	72.202	71.985
H	4.99	4.975
S	1.18	1.177
Ash	17.227	17.175
Moisture	0.000	0.300
S	1.180	1.177
N	1.428	1.424
O (diff.)	2.973	2.964
	100.000	100.000

One pound of dry coal yields when fired:

CO_2	2.647 lb.
N	7.736 lb.
H_2O	0.452 lb.
	10.835 lb.
Add 5% excess air	0.542 lb.
	11.377 lb.

One pound of standard coal of 12,600 B.t.u. per lb. is equivalent to $\frac{12600}{12710} = 0.9913$ lb. of this coal; 0.9913 lb. of this coal, therefore, yields 12,600 B.t.u., and will yield:

CO_2	$0.9913 \times 2.647 = 2.624$ lb.
N	$0.9913 \times 7.736 = 7.669$ lb.
H_2O	$0.9913 \times 0.452 = 0.448$ lb.
Excess air	$0.9913 \times 0.542 = 0.537$ lb.
	11.278 lb. of gas

The percentage composition of this mixture by weight is:

CO_2	23.267 lb.
N	67.996 lb.
H_2O	3.973 lb.
Excess air	4.764 lb.
	100.000 lb.

Products of Combustion from a Coal of 11,851 B.t.u. per 1 Lb. Compared to Products from Standard Coal

(Works Test, No. 10, L.C. 15.)

This coal had the following composition when dried:

			Mean.
C	65.98	65.74	65.86
H	4.55	4.55	4.55
S	1.32	1.42	1.37
Ash	19.76	19.76	19.76
O	7.00	7.13	7.06
N	1.39	1.40	1.40
	100.00	100.00	100.00

One pound dry coal yields when burnt:

CO_2	2.41 lb.
N	6.84 lb.
H_2O	0.41 lb.
	9.660 lb.
Add 5% excess air	0.483 lb.
	10.143 lb.

One pound of standard coal of 12,600 B.t.u. per lb. is equivalent to $\frac{12600}{11851} = 1.063$ lb. of this coal; 1.063 lb. of this coal, therefore, yield 12,600 B.t.u. and will yield:

CO_2	$2.41 \times 1.063 = 2.56183$ lb.
N_2	$6.84 \times 1.063 = 7.27092$ lb.
H_2O	$0.41 \times 1.063 = 0.43583$ lb.
Excess air	$0.483 \times 1.063 = 0.51343$ lb.
	10.78201 lb. of gas

corresponding to 12,600 B.t.u. liberated.

The percentage composition of the mixture is by weight:

CO_2	23.760 lb.
N_2	67.436 lb.
H_2O	4.042 lb.
Excess air	4.762 lb.
	100.000 lb.

Calculation of Quantity of Air Required to Produce Weights of Combustion Gas Equivalent in Heating Power

From the preceding calculations it is seen that the liberation of (*a*) 11.278 *lb. of gas* produced from the combustion of a coal of 12,710 B.t.u. per lb., and (*b*) 10.782 lb. of gas produced from the combustion of a coal of 11,851 B.t.u. per lb. each correspond to the liberation in the furnace of 12,600 B.t.u. from the coal—*i.e.*, are equivalent to the combustion of 1 lb. of standard coal in the furnace. We wish now to calculate how much *air* has to be supplied (*a*) to make the 11.278 lb. of gas, and (*b*) to make the 10.782 lb. of gas in the two cases above mentioned. For obviously, if the cold air is drawn into the furnace from the atmosphere, the heat must be supplied for preheating this cold air, and if the quantities of air so supplied are different, obviously different quantities of heat must be supplied for this purpose. The matter is, therefore, of considerable practical importance. Calculation of the quantity of air required to burn:

In case (*a*) 0.9913 lb. of coal has to be burnt to liberate 12,600 B.t.u.

In case (*b*) 1.063 lb. of coal have to be burnt to liberate 12,600 B.t.u.

Coal (a)—Calorific value, 12,710 *B.t.u. per* 1 *lb. composition.*

C	72.202
S	1.180 = 0.4425 C.
H	4.990
Ash	17.227
N	1.428
O (diff.)	2.973
	100.000

In order to calculate the amount of air required for combustion, we assume as correct the available percentage of hydrogen as $H - \frac{O}{8}$.

$$H = 4.990 - \frac{2.973}{8.000} = 4.990 - 0.372.$$

$H = 4.618\%$.

Hence 1 lb. of H requires 34.782 lb. of air to burn to H_2O.

Therefore 0.04618 of H requires $0.4618 \times 34.782 = 1.6062$ lb. air.

The percentage of carbon and its equivalent of sulphur (C = 72.202; S = 1.180 = 0.4425 C.) in the coal amounts to 72.6445%.

One pound of carbon requires 11.594 lb. of air to burn to CO_2.

0.72645 lb. of carbon requires $11.594 \times 0.72645 = 8.4225$ lb. of air.

Hence the total amount of air required to burn 1 lb. of fine coal is:

= 8.4225 lb.
1.6062 lb.

10.0287 lb.

Weight of air needed to burn 0.9913 lb. is 10.0287×0.9913.

= 9.94145 lb.
Add excess air = 0.537 lb.

10.478 lb.

Total air required to burn 0.9913 lb. of *coal* and liberate 12,600 B.t.u. is 10.478 *lb. air.*

Coal (b)—Calorific value, 11,851 *B.t.u. per* 1 *lb.*

This coal, when dried, had the mean composition:

C	65.86
H	4.55
S	1.37
Ash	19.76
O	7.06
N	1.40
	100.00

Available H for combustion is

$$4.55 - \frac{7.06}{8} = 4.55 - 0.88 = 3.67\%$$

Available C for combustion + equivalent of S is:

$$65.86 + \frac{1.37 \times 12}{32}$$

$$= 65.86 + 0.51$$
$$= 66.37\% \text{ C.}$$

Hence 1 lb. of this coal contains:
0.0367 lb. of H available for combustion.
0.6637 lb. of C available for combustion.

Since 1 lb. of H requires 34.782 lb. of air for combustion,
0.0367 lb. of H requires of air $0.0367 \times 34.782 = 1.2765$ lb. of air.

Since 1 lb. of C requires 11.594 lb. of air to burn to CO_2,
0.6637 lb. of C requires $11.594 \times 0.6637 = 7.6949$ lb. of air.

Hence per 1 lb. coal the total air required for combustion is:

$$1.2765 + 7.6949 = 8.9714 \text{ lb.}$$

Hence the *amount of air* required to burn 1.063 lb. of this coal so as to liberate 12,600 B.t.u. in the kiln is:

$$1.063 \times 8.9714 = 9.536 \textit{ lb. of air.}$$

Add to this 0.51343 lb. of excess air and we get the total amount of cold air required to liberate 12,600 B.t.u.:

$$9.53660 + 0.51343 = 10.05 \textit{ lb. of air.}$$

SUMMARY—For the purpose of the succeeding calculations we will take it that the combustion of 1 lb. of *standard coal* of 12,600 B.t.u. per lb. will yield 11.278 lb. of combustion gas composed as follows:

Gas	
CO_2	2.624 lb.
N_2	7.669 lb.
H_2O	0.448 lb.
Excess air	0.537 lb.
	11.278 lb.

The percentage composition of this mixture by weight is:

CO_2	23.267 lb.
N_2	67.996 lb.
H_2O	3.973 lb.
Excess air	4.764 lb.
	100.000 lb.

The weight of air necessary for the combustion of 1 lb. of the coal so as to give a combustion gas of the preceding composition is 10.478 lb. of air.

(To be continued)

J. D. Johnson Elected President of Canada Cement Co.

J. D. JOHNSON has been elected president of Canada Cement Co., Ltd., Montreal, Que., to succeed A. C. Tagge, who is retiring as head of the company after serving the organization in an official capacity since 1909. Mr. Tagge is remaining on the board. Mr. Johnson has been reappointed general manager and H. L. Doble continues as vice-president, comptroller and secretary-treasurer.

J. D. Johnson

A. C. Tagge, president, referring to his statement in annual report that no accident was reported in any of the company's four plants during the past year, remarked that an accident had occurred on December 21 in one plant, but that the other three plants had a clear record.

Mr. Johnson, the new president, came up in the company through the sales department, but during the last few years, as vice-president and general manager, has had much to do with operation also. He is a member of the conservation committee of the Portland Cement Association.

The End of One West Coast Cement Mill

SUGARMAN BROTHERS, of San Francisco, Calif., have purchased the abandoned plant of the Pacific Portland Cement Co. near Fairfield, Calif. The plant cost $6,000,000 and it is understood that the lower bay firm paid in the neighborhood of $1,000,000 for the buildings and machinery. The plant is to be wrecked this winter. P. A. Sugarman says he will endeavor to sell some of the machinery in Denver.—*San Francisco* (Calif.) *Chronicle.*

Cement Price Cut in East

THE Pennsylvania-Dixie Cement Corp., Philadelphia, announced a reduction of ten cents a barrel in portland cement, effective January 8 in Washington, Baltimore and points in Maryland. The Lehigh Portland Cement Co. announced a similar reduction in Maryland and the District of Columbia. The cut was made to meet price shading by smaller companies, it was said.

Boston Bans Imported Cement for City Jobs

DOMESTIC CEMENT MANUFACTURERS are encouraged over the action of Mayor Curley of Boston, Mass., in banning the use of Belgian cement by contractors working on city improvements. The mayor's attitude was based on the patriotic ground of the necessity of helping to keep American factories in operation.

North American Cement Corp. Operating Catskill Plant

THE CATSKILL, N. Y., PLANT of the North American Cement Corp. is operating on a 60% basis at the present time employing approximately 140 men. This plant was shut down for 45 days during the year 1930.

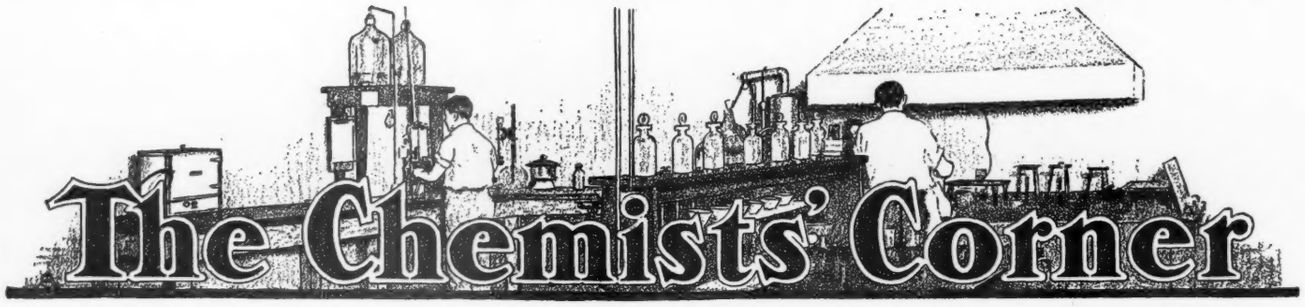
The policy of the company was to operate this plant on curtailed production throughout the year which enables them to continue operation until about the first of February, 1931. The plant will then shut down for a period of 30 days and during his period considerable repairs and replacement of machinery will take place which will give employment to quite a number of men during this period.—*Hudson* (N. Y.) *Register.*

Universal Atlas Cement to Install Waste-Heat Boilers at Buffington

AN INDICATION that the cement industry has faith in the business stability of the country is shown in the placing of a $400,000 order for fourteen 830-hp., high-pressure, waste-heat boilers with the Henry Vogt Machine Co. of Louisville, Ky., by Universal Atlas Cement Co., Chicago, Ill. The new equipment will be used in the Buffington, Ind., plant of Universal Atlas, which is a subsidiary of United States Steel Corp.—*Chicago* (Ill.) *Daily News.*

Inspection of Cement Laboratories

THE Cement Reference Laboratory is now arranging for a second tour of inspection of the cement testing laboratories throughout the country. This service, which at present consists of inspecting cement testing apparatus and demonstrating test methods, is rendered without charge. The laboratories which desire this inspection should make prompt application. Application should be addressed to the Cement Reference Laboratory, care Bureau of Standards, Washington, D. C.



Chemical Composition—Influence on Manufacture and Quality of Cement

By Alton J. Blank

General Superintendent and Supervising Chemist, Compania de Cemento Portland "Landa," S. A., Puebla, Puebla, Mexico

OF THE CHEMICAL constituents of a portland cement, that of the alumina has an important bearing upon its manufacture and quality.

Perusal of the available literature on portland cement manufacture and quality shows great space devoted to the part played by the chemical ingredients as a whole, but with little space devoted to the part played by the alumina ingredient. Whether this is overlooked, due to limited knowledge of the subject, or due to the fact that authors as a whole are disinclined to go into detail in this respect, is not known.

While the average portland cement contains approximately 7% of alumina, some cements are to be found with as high as 10% and as low as 5% of this ingredient. However, these cements are in the minority.

Usually those cements having exceptionally high alumina contents have correspondingly low silica or iron oxide contents. Such cements, as have come under the observation of the writer at a number of plants, have been the most difficult, and in consequence the most expensive cements to manufacture.

Yet, in being the most expensive cements, they are not always found to be the highest as to quality.

The relation of the percentage of alumina in a cement to the percentage of silica, namely, the silica/alumina ratio, is of great importance in so far as manufacturing conditions are concerned, and of lesser import in connection with quality.

The relation of the percentage of alumina to the percentage of iron oxide in a cement, namely, the alumina/iron oxide ratio, has a bearing on both manufacture and quality.

At a plant with which the writer was connected some years ago, due to the wide variation in results obtained in the manufacture of cement, which varied as to composition from time to time, considerable attention was focused upon the part played by the alumina content of the cement. To illustrate this influence a series of curves were plotted on normal monthly mill and laboratory averages covering a period of several years, care being taken to select only those monthly averages which were not affected by adverse mill operating conditions, or variations in the cement composition other than that as outlined in the charts shown herewith.

A typical analysis of the cement manufactured at this plant is as follows:

SiO_2	20.84%
Al_2O_3	6.68%
Fe_2O_3	3.12%
CaO	62.54%
MgO	2.04%
SO_3	1.88%
Loss	2.00%

Chart No. 1

In Chart No. 1, those kiln outputs and fuel consumptions as received during the 20 selected months are plotted against the alumina/iron oxide ratio of monthly average clinker (from the laboratory records).

Perusal of the curves in Chart No. 1 shows that a variation from one extreme to the other of the alumina/iron oxide ratio of the clinker results in a difference of 20% in the kiln output in barrels per hour, and in a difference of 25% in the consumption of fuel per barrel of clinker output.

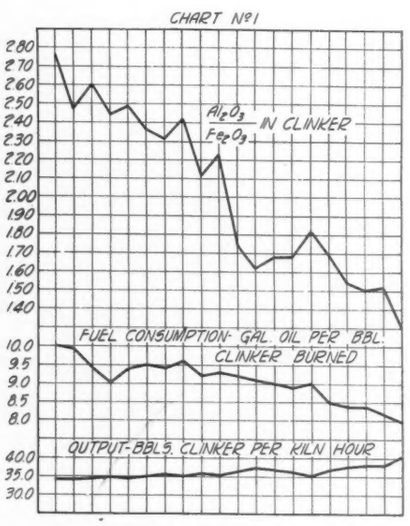


Chart No. 2

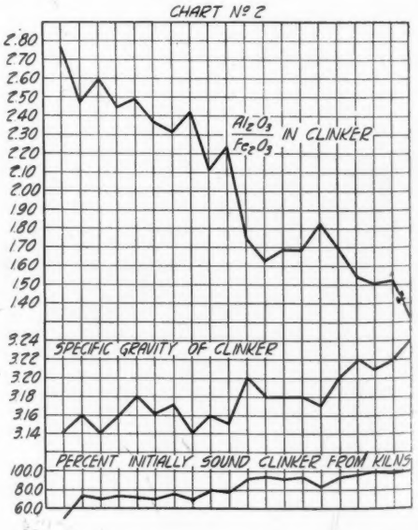
In Chart No. 2, covering the same period of months as shown in Chart No. 1, the specific gravity and soundness of the clinker is plotted against the alumina/iron oxide ratio of the average monthly clinker.

Perusal of the curves in Chart No. 2 shows the variation of the alumina/iron oxide ratio of the clinker to result in a difference of 0.10 in the specific gravity of the clinker, and in a difference of 50% in the unsoundness of the clinker.

Chart No. 3

In Chart No. 3 the average monthly tensile strengths of the cement at ages of 24 hours to and including one year is plotted against the alumina/iron oxide ratio of the cement as taken from laboratory records. In the selection of the 17 months' averages as shown in the chart, care was taken in the selection of only those months not influenced to any extent by the age of the clinker, the cement fineness or variation as to chemical composition other than shown. At the time these curves were plotted, certain tension tests at the various ages were incomplete.

Perusal of Chart No. 3 shows those cements having the lower alumina/iron oxide ratios to have the higher strengths.



Clinkers of Different Types

At another plant utilizing raw materials of variable alumina content, results obtained in the manufacture of two types of clinker from these materials was noted, the results of which are shown herewith. Analyses of the two types of clinker produced during the several weeks during which time observations were made are as follows:

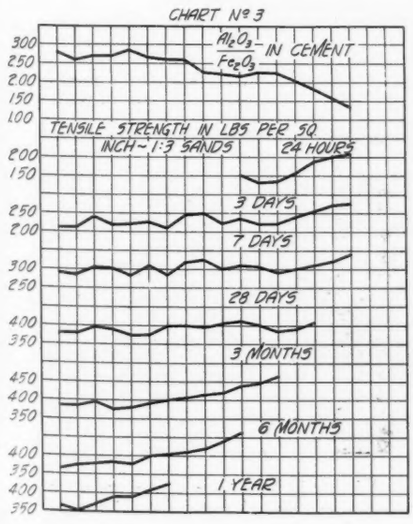
Chemical analysis	Clinker No. 1	Clinker No. 2
SiO_2	21.78%	20.16%
Al_2O_3	6.71%	8.44%
Fe_2O_3	3.32%	3.18%
CaO	64.86%	64.70%
MgO	1.84%	1.86%
Loss	0.58%	0.64%
Output from kiln, bbl. per hour	47.5 %	33.8 %
Fuel consumed, gal. oil per bbl.	8.3 %	9.4 %
Soundness of clinker	100.0 %	72.0 %
Specific gravity of clinker	3.15%	3.21%
Output preliminary cement mills, in bbl. of cement per hour	61.2 %	50.4 %
Kw.h. consumed per bbl. reduced	1.3 %	1.9 %
Output fine grinding cement mills, in bbl. of cement per hour	34.8 %	30.2 %
Kw.h. consumed per bbl. ground	3.6 %	4.2 %

Perusal of the above results shows the disadvantages of the high, alumina/iron ratio mixtures in so far as their passage through the kilns and grinding mills is concerned.

A High Alumina Clinker

At another plant the writer had an opportunity of noting the operation of a kiln which had been over-heated and had resulted in the raw mixture in the kiln combining with the high alumina refractory brick in the burning zone, causing hot-spots to appear on the shell of the kiln and necessitating the shutting down of the kiln for relining. The clinker as discharged from the kiln averaged 6 in. in diameter, was green in color and disintegrated into powder form upon becoming cool.

Analysis of this clinker is as follows:



Prize Awards

WITH the introduction of the "Chemists' Corner" of Rock Products, March 15, 1930, contributors, in addition to liberal payment for their articles at space rates as published, were promised a chance to win prizes of $100, $50 and $25, respectively, for first, second and third choices of the best papers, or articles, or letters, contributed and published during the year.

It was expected to have the awards made in time for Christmas, but the deaths, during the last few months of 1930 of two of the judges who were to determine the prize winners, somewhat complicated matters. These judges were the late Richard K. Meade and Harry E. Brookby. The surviving judge is P. H. Bates, of the United States Bureau of Standards, who, with Dr. F. O. Anderegg, consulting chemist, Pittsburgh, Penn., have been most helpful to the editor in arriving at a solution of the problem of determining the prize articles.

S. L. MEYERS, Southwestern Portland Cement Co., El Paso, Tex., wins the first prize of $100 for his paper "Breaking Down of Tricalcium Silicate by Heat," published in the April 12 issue.

KATSUZO KOYANAGI, Chichibu Cement Co., Japan, wins the second prize of $50 for his paper "Accounting for Ignition Loss in Analyses of Clinker," published in the August 16 issue.

ALTON J. BLANK, Landa Portland Cement Co., Mexico, wins the third prize of $25 for his paper "Studies of the Lime Ratio in Cement," published in the December 6 issue.

In selecting the prize winners all judges concurred in selecting one of these articles as worthy of a prize award. The other two articles are the first choices of one judge each. The final choice of first, second, and third, had to be made on the basis of their relative value as original contributions to the knowledge of the chemistry of the industry, or as reports of original research, rather than on their practical value to cement plant chemists. This was done because the primary intention in offering the prizes was to stimulate original research and thinking on the part of the chemists in the industry. Articles of practical value to chemists, even if merely detailing routine methods, are welcome contributions, and from another point of view should perhaps be judged by their practical value.

Contest Continued

The contest will be continued and prizes will again be awarded for the papers published in 1931. All contributions received during the latter part of 1930 and not yet published will, of course, automatically be entered in the 1931 contest.—The Editor.

SiO_2	20.30%
Al_2O_3	13.50%
Fe_2O_3	3.20%
CaO	58.00%
MgO	2.04%
SO_3	0.75%
Loss	0.80%

This clinker, upon being mixed with gypsum and ground to ordinary cement fineness, had the following physical characteristics:

Soundness	Bad
Setting time	Flash

Tension	Lb. per sq. in. Neat	Lb. per sq. in. 1:3 sand
3-day	105	48
7-day	148	*
14-day	169	*

*Disintegrated.

The above, being a freak cement, is shown to the end that it may conform with similar results obtained at other mills.

The effect of high alumina content upon manufacture and quality is more readily shown in the production of white portland cement, these cements being extremely hard to burn and grind together with bordering on unsoundness and yielding a product none too good as to strength qualities. While the writer's experience has been of experimental nature, it coincides with results obtained on large scale manufacture.

Summary

Summed up, the influence of high alumina content in portland cement upon its manufacture and quality, as has come under the experience of the writer, is as follows:

(*a*) *BURNING:*

(1) As the percentage of alumina (within limits) increases in raw cement mixtures, the temperature required for burning increases in proportion, affecting output and kiln fuel consumptions.

(2) Ring formations in kilns are due in part to high alumina content of the raw mixtures, and in coal-fired kilns where coal ash combines with the raw mixtures, this is particularly true.

(3) High alumina clinker is greenish of color and uniformly small in size.

(4) High alumina clinker has a tendency towards unsoundness.

(*b*) *GRINDING:*

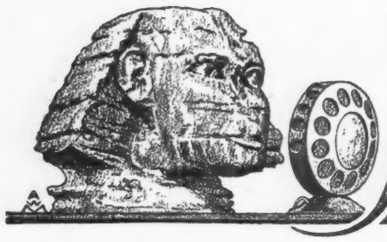
(1) High alumina clinker is exceedingly hard to pulverize in both the preliminary and fine grinding cement mills.

(*c*) *QUALITY:*

(1) The higher the percentage of alumina present in a cement, the quicker will be its set. Quick setting cements due to alumina are little affected by the increased addition of gypsum. High alumina cements of initially normal setting time, due to decomposition on storage, may become quick setting.

(2) High alumina cements have a tendency towards unsoundness and show the greater expansions. High alumina cements have the higher heat of hydration, and show irregular increase in volume.

(3) High alumina cements, though showing normal strengths at early ages, are inclined towards retrogression at later ages.



Hints and Helps for Superintendents

Rebuilding Dipper Teeth

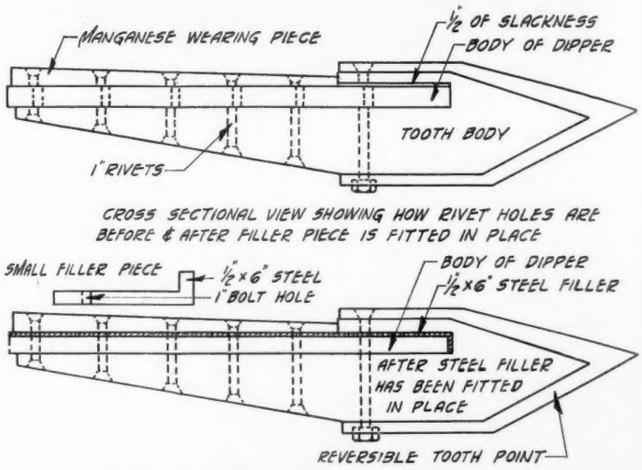
By C. H. Wright
Snyder, N. Y.

THE ACCOMPANYING PICTURE represents a steam-shovel dipper of a 3-yd. type, and to look at it, a person would say that it is practically worn out, and by some operators would be discarded and thrown into the scrap pile, but in my estimation if this bucket is not broken any place about the manganese body, it can be used in good hard every day digging if properly repaired and taken care of. Oftentimes the dipper is thrown away because the rivet holes in the body and the teeth do not line up so rivets can be made to hold. Under these conditions without the filler piece, the operator will always have delays and perhaps pay out big money for Sunday repairs, when it is not necessary. And the teeth break off, due to the ½ in. of slackness, and are not properly riveted to the shell of the dipper, perhaps causing a portion of the tooth to be dumped into the cars and unloaded into the crusher, which might cost an enormous sum for repairs on the crusher, if the broken tooth and point is not detected in time.

This worn steam-shovel dipper can give good service if properly repaired

For the past four or five years the wear on this dipper had been just about as the picture shows, but with careful attention given to repairs in the winter months, we use this dipper through the working season with scarcely any time lost for repairs.

This picture does not show any corner wear, but nevertheless it is worn to a very great extent, and in my next writing I will explain just how this particular portion of the dipper is taken care of.



Cross-section of dipper tooth and body of dipper, showing rivet holes before and after filler piece is fitted in place

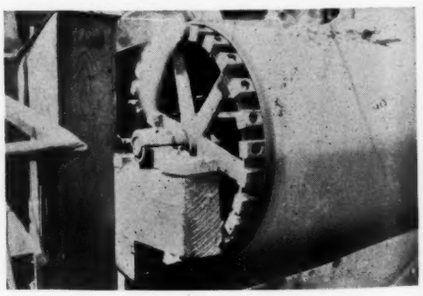
Referring to the two sketches, showing first a cross-section of a dipper tooth and the body of the dipper, badly worn in the rivet holes by continuously forcing dipper teeth against the shell of the dipper when working in a rock bank; with this condition, it is almost impossible to keep the rivets in the teeth, because the teeth have to be raised off the body of the dipper so the holes in the teeth and the holes in the body of the dipper will be in line, so rivets can be put in and riveted up solidly. One can almost imagine what will happen to the rivet when these teeth are forced into the rock bank with plenty of steam behind the dipper, and without these filler pieces. In a very short time new rivets will have to be put in again, because they are sheared or broken off. The second sketch shows how a filler strip is fitted and the results.

First a piece was made as per sketch, to fit under the tooth and over the lip of the dipper. This piece is held in place by the bolt that holds the tooth point on the body of the tooth. This did not work out very successfully because when the bolt broke, oftentimes we lost the little filler. So we made the filler the whole length of the tooth, every rivet in the tooth going through the filler, which made a smoother surface for the manganese wearing strip to fit up against. Not only does this filler piece keep the tooth from working down on the mouthpiece of the dipper, causing the holes to be irregular, but it also takes up the slack that was caused by excessive wear of the teeth on the lip of the dipper, and with this filler the tooth is very much firmer in every respect. Some teeth and portions of the dipper wear more than others, so care must be taken not to have the filler so thick that the dipper tooth will have to be forced on hard enough to cause the short piece or outside part of the tooth to break off. Just simply a snug fit.

With this improvement it is not necessary to put in very many rivets during a working season unless through someone's carelessness a tooth should get broken.

Simple Device Keeps Conveyor Belts from Slipping

WHILE CONVEYOR BELTS are usually designed to obtain the most efficient traction on the drive pulley and hence the least slippage, it sometimes happens that belts do slip, particularly in wet weather. M. Christenson, the superintendent at the Burlington, Wis., sand plant of the North Shore Material Co., has placed in operation at his plant a simple and effective method of preventing belt slippage on all of the drive pulleys of the plant. He had a number of

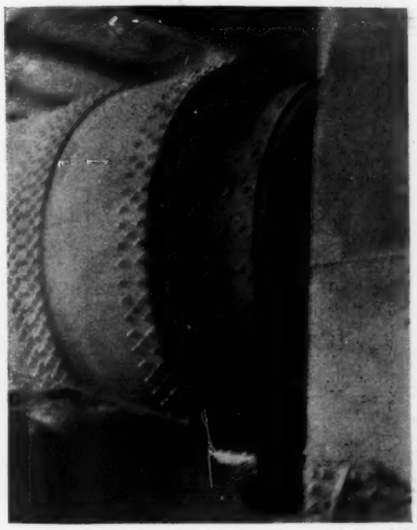


Cleats bolted to a drive pulley on a heavy belt prevent slippage

maple cleats made sufficient to cover completely all of his pulleys. These cleats are spaced about an inch apart and are themselves about an inch square in cross-section. They measure slightly longer than the width of the face of the pulley. Holes were bored in the metal of the pulley near the outer edges and corresponding holes were bored in the cleats, the latter being counterbored to receive the head of the bolt. The cleats were then bolted to the pulley resulting in a better tractive force for moving heavy belts.

Preventing Rotary Kiln Heat Losses

HEAT LOSSES at the end of a rotary kiln due to the admission of an excess of cold air is a subject receiving considerable attention. Elaborate calculations are published from time to time on this subject but very little data are available as to how the other fellow has cut down these heat losses, especially on old kilns, the ends of which do not as a rule lend themselves to easy alteration so as to make a tight fit.



Bottle-neck type of connection on rotary kiln decreases heat losses

A West Coast cement-mill operator with this in mind, and also to secure a deeper bed of clinker in the hot zone, adopted a bottle-neck type of connection between the end of the kiln and its housing. The illustration will give the cement-kiln, or lime-kiln, operator a better idea as to how this was accomplished than any written description. Better burning conditions were expected to be secured by the use of a deeper bed of clinker.

Packing-Machine Installation Protected from Settlement

IN SETTING UP a Bates valve-bag packer, especially in a frame building, there is apt to be some settlement of the feed-bin columns after the installation is in operation a short time. This throws an unnecessary load upon the packer, which it is not designed to carry. Again, if it becomes necessary to take out the packer it can only be done with extreme difficulty.

At an Idaho portland cement plant the hopper is placed about 8 in. above the top of the packer and is connected to it by a canvas tube-like member, so that the above-mentioned difficulties are overcome. Using canvas at this point also is otherwise advantageous, for the operator can tell when his hopper is empty without pounding on the outside of the bin and forming an opinion based on the sound; or if the products being sacked tend to hang up, they can be easily brought down by simply poking the canvas connection with the hand.

Unloading a Crane After Shipment

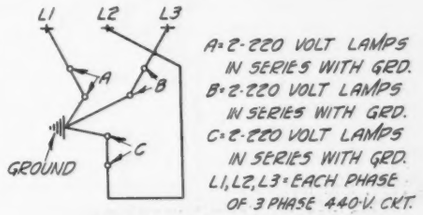
THE USUAL METHOD of unloading a crane or shovel from a flat car after shipment is to build up a heavy runway to the car and take the crane down this under its own power. Another method was used by the Hecker company, building material dealers of Champaign, Ill. First large railroad jacks were obtained and the flat car was jacked up so that the weight was off the trucks. Then the bolster pin holding the truck was loosened and the trucks were free to roll out from under the car. The jacks were then used to let the car down gradually until it nearly rested on the rails. From this position only a few ties were necessary to complete a runway for the crane. After the crane was off, the car was jacked up again, the trucks run under and secured, and the job was done, except for connecting up the brake rods, which had been loosened to remove the trucks.

This method requires much less material to carry out, and moreover the company's engineer stated that it was much more rapid than the usual method. However, it is best to ask the railroad before you take its car apart.

Ground Detector

By W. L. Home
Englewood, N. J.

THE DIAGRAM herewith shows a ground detector used on a 440-volt, 3-phase, electrical system. As long as the lamps, *A*, *B*, and *C*, were burning brightly every phase of the system was free of grounds. Immediately upon grounding one or more phases the lights will go out or at least dim. On construction work where motors and electrical equipment are moved around a great deal and are subject to a lot of vibration such a detector placed in a compressor room or engine room will save a lot of troubles.



Ground detector used on a 440-volt, 3-phase electrical system

The hopper is placed about 8 in. above the top of the packer and connected to it by a canvas tube-like member

Transit-Mixed Concrete Manufacturers Hold Annual Meeting

THE FIRST ANNUAL MEETING of the National Association of Paris Transit Mixed Concrete Manufacturers was held at St. Louis, Mo., January 9-12, with operators in attendance from all parts of the country and representing more than 70% of the Transit mixer equipment in use.

The opening meeting was presided over by Porter W. Yett, president, with Edward A. Landis as executive secretary, both of Portland, Ore.

The association, which has about 50 members, was formed at Chicago, April 15-16, 1930, and has as its purpose the furtherance of the use of Transit mixed concrete and the exchange of information between members.

During the four-day session a great many matters of importance were discussed and decisions reached on policies and future activities, the meeting closing with the election of officers for the ensuing year.

The following officers were elected: Bruner R. Penniman, Penniman Concrete and Material Co., Dallas, Tex., president; Edward J. Flynn, Transit Mix Concrete Co., Morris Plains, N. J., Eastern vice-president; B. L. Barlow, C. S. Barlow and Sons, Tacoma, Wash., Western vice-president.

Bruner R. Penniman

Ready to Co-operate With Other Associations

A resolution was passed endorsing the National Ready-Mixed Concrete Association and its work, and expressing a desire to co-operate with that and all other organizations in the interests of ready-mixed concrete.

It is expected that within a short time quite complete technical information covering the manufacturing arrangements and methods of the various producers will be collected, charted and tabulated, and the combined data distributed to the members. This exchange of information should be helpful in raising even higher the standards of production.

At the first day's session an interesting paper was read by M. D. Catton of the Portland Cement Association, Chicago, on the subject of "Pre-Manufactured Concrete."

Mr. Catton emphasized the importance of making a quality concrete and predicted that the growth and development of this new industry will depend upon the extent to which that is done. He explained that quality, meaning the strength, durability and workability of the concrete when placed at the job, is what counts and that it may be obtained by using properly graded aggregates, in correct proportions, with a proper amount of water in relation to the cement used. A natural grading of the aggregates, both coarse and fine, so that they contain many sizes rather than having one or two sizes predominate, makes for less voids and maximum strength, and also improves workability and reduces segregation.

For greatest economy, Mr. Catton said, only enough fine aggregates should be used to properly fill the voids in the coarse aggregates. All proportioning should be by weight and not by volume, and the water-cement ratio should be used in designing the mix, since research in making concrete has shown that the ratio of water to cement bears a definite relationship to strength and also affects the durability and permeability of the concrete. Along that line the Portland Cement Association has recommended water-cement ratios ranging from 5½ or 6 gal. of water per sack for exposed concrete in severe climates, up to 7½ or 8 gal. for protected concrete not subject to severe climatic conditions.

Mr. Catton recommended sound procedure in the way of standard tests by recognized laboratories or engineers in order to maintain uniform quality and also the employment of a concrete engineer to develop fully the possibilities in pre-manufactured concrete.

Mr. Knowles of the Transit Mixers, Inc., San Francisco, Calif., also spoke on the improvements which have been made in this type of mixer and of further improvements which may be expected, particularly the possibilities of obtaining higher strength concrete by mixing under pressure.

Motion pictures were shown of some of the construction jobs supplied with concrete by Swigert, Hart and Yett, Portland, Ore., particularly the concrete silos of the Dock Commission of Portland, the St. Johns bridge over the Willamette river and the 14-story Myron Frank building in the downtown section. These were interesting, as showing the manner in which the concrete was placed and its appearance and workability. The dock job, involving 72 bins 79 ft. high, was poured continuously using slip forms and was completed in a little more than six days.

Attendance (Producers)

C. S. Barlow and Sons, Inc., Tacoma, Wash., B. L. Barlow.

Boice Bros., Pontiac, Mich., E. C. Boice, O. E. Boice.

Boston Transit Mixers, Inc., Boston, Mass., M. A. Howe, A. I. Merigold.

General Material Co., St. Louis, Mo., H. F. Thomson.

Loizeaux Builders Supply Co., Elizabeth, N. J., J. Harold Loizeaux.

Maloney Paving Co., Washington, D. C., Charles P. Maloney.

McCrady-Rodgers Co., Pittsburgh, Penn., James H. McCrady.

Metropolitan Concrete Co., Cleveland, Ohio., W. F. Crangle.

Penniman Concrete and Material Co., Dallas, Tex., Bruner R. Penniman.

Swigert, Hart and Yett, Inc., Portland, Ore. Edward A. Landis, Porter W. Yett.

Transit Mixed Concrete Co., Cincinnati, Ohio., Jules T. Gradison.

Transit Mix Concrete Co., Morris Plains, N. J., Edward J. Flynn.

Transit Mixed Concrete Corp., New York City, A. Gull.

Turner Gravel Co., San Antonio, Tex., A. P. Turner.

OTHERS

Hugh P. Paris, Oakland, Calif.

James E. Sproll, Seattle, Wash.

Portland Cement Association, M. D. Catton, Chicago, Ill.

ROCK PRODUCTS, E. C. Harsh, Chicago, Ill.

Transit Mixers, Inc., Edwin F. Hill, Jr., A. Knowles, San Francisco, Calif.

State Gravel Co., Mississippi, Buys Another Plant

THE STATE GRAVEL CO., with offices in Jackson, Miss., has acquired a large gravel plant located two miles northeast of Crystal Springs on a spur line of the Illinois Central railroad.

In addition to this plant, the company has acquired deposits on the G. M. and N. and the Ship Island roads, and is negotiating for two deposits in northern Mississippi.

The Crystal Springs plant, the company says, will be the first to be put into operation, and is considered "the best location and the best deposit we have in the state." The gravel deposits to the northeast and northwest of Crystal Springs have been from time to time successfully mined.

It is estimated that 54,000 miles of roads in Mississippi require gravel, some to remain graveled, and some later hard surfaced. About 2,000 cu. yd. of gravel and 1500 cu. yd. of sand are estimated for a mile of concrete road.—*Gulfport* (Miss.) *Gulf Coast Guide.*

Editorial Comment

OUR PLATFORM

¶ Greater Economy of Production; the Best in Machinery, Control Equipment; High Wages; Perfect Co-ordination. ¶ Comprehensive Organization of Industry for Research, Promotion. ¶ Retirement of the State from Competition with Private Business. ¶ Active Participation of Business Men in the Business of Government. ¶ The Promotion of Safety and Welfare of the Industry's Employes.

Convention Time

Between the time of issue of this edition of ROCK PRODUCTS and the next there will have occurred three important annual conventions of the industry — all in the city of St. Louis. That of the National Crushed Stone Association comes first, then the National Ready Mixed Concrete Association, and last the National Sand and Gravel Association. All three are intimately connected, one with the other, and it is a healthful and significant sign of the times that all three are meeting in the same city at approximately the same time.

Whether or not all three organizations would be better off under a single banner and a united leadership is probably an open question at this moment; but it is a question we hope will be frankly discussed during the coming two weeks in St. Louis, if not officially on the floor of the conventions, at least unofficially in committee rooms and in bed chambers. There are undoubtedly many good arguments on both sides.

It is significant, however, that during the last few weeks the Texas producers of sand gravel and crushed stone have united in a single association. For in Texas rivalry between the two groups was for a long time as evident as it was, or is, anywhere else. Here, then, is proof enough that these differences can be peacefully composed under able and enlightened leadership. A union of the New York State crushed stone and gravel associations has been discussed by these associations in open sessions. If this union is accomplished, it is difficult to see why a union of the two national associations is not as easily made. When the crushed stone, slag and gravel interests in Pennsylvania decide to unite, then the millennium surely will have arrived!—and the last argument will have been answered to the satisfaction of all.

The next best thing to an actual union of the associations, of course, is the happy coincidence of their meetings coming together in the same place at about the same time. We hope the precedent thus established will be maintained, because every year sees more and more overlapping of individual interests, and all the associations should profit in attendance and interest by the arrangement. It is regrettable that the National Slag Association did not hold its meeting in St. Louis during the same two weeks—for while small in number, its members are powerful factors in the aggregate industry in the Eastern part of the country.

State Materials Engineers' Comments

The comments of various state highway material or testing engineers, published elsewhere in this issue, on the research work of the three national aggregate associations, is interesting in connection with the foregoing. It is evident that they see two sides to the proposition of combining this work under one organization. Some think it is desirable to have three separate laboratories "to check each other's work." Others think the work of all three would have much more weight if done in one laboratory. As to one laboratory checking the other, in the first place we don't believe this is necessary, with the present men in charge of the laboratories; but if it is, the same checking process would be just as surely accomplished if the laboratories were one. For it is obvious that the results of such a united laboratory could hardly be satisfactory all the time to all the three groups, consequently its findings would have to be "checked and double-checked" before publication.

The purpose of the research work of these associations has been primarily to provide information for the more effective and efficient use of aggregates. Comparisons between various types of aggregate are inevitable. But the moment these comparisons become offensive or defensive, the prestige of the laboratory issuing them is in danger. If the issue was from a joint laboratory it would first have to be accepted by all three interests as "bullet-proof."

One thing is quite certain. The combined laboratory of the three associations would have more adequate funds and a more adequate personnel to work with than any one of them can possibly have. With more and more producers interested in two, or sometimes all three types of aggregate, the illogical situation of contributing to the support of the two or three laboratories, for practically the same ultimate ends, becomes constantly more evident. Such a combined laboratory, properly equipped, would also have such prestige as to justify its making a bid for research work on cement concrete or asphaltic mixtures, to be paid for by associations or individuals outside of the aggregate industries, but from which the aggregate producers would undoubtedly profit indirectly. Such independent research would help dispel the unjustified feeling on the part of engineers that the work of the present laboratories is too one-sided to be accepted at face value.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[20]	1-14-31	93	.....	
Alpha P. C. new com.[2]	1-10-31	15	17	50c qu. Jan. 24
Alpha P. C. pfd.[2]	1-10-31	118	.....	1.75 qu. Dec. 15
American Aggregates com.	1-13-31	6	9	75c qu. Mar. 1
Am. Aggr. 6's, bonds	1-13-31	75⅛	77	
American Brick Co., sand-lime brick	10- 6-30	4½	.....	25c qu. Feb. 1
American Brick Co. pfd.	1-12-31	50	57	50c qu. May 1
Am. L. & S. 1st 7's[29]	1-14-31	97	99	
American Silica Corp. 6½'s[49]	1-13-31	No market		
Arundel Corp. new com.	1-12-31	40⅝	41	75c qu. Jan. 2
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)*	1-13-31	No market		
Beaver P. C. 1st 7's[20]	1- 7-31	93	95	
Bessemer L. & C. Class A[4]	1- 9-31	28	30	75c qu. Nov. 1
Bessemer L. & C. 1st 6½'s[4]	1- 9-31	90	93	
Bloomington Limestone 6's[20]	1-14-31	50	55	
Boston S. & G. new com.[47]	1-10-31	15	18	40c qu. Jan. 2
Boston S. & G. new 7% pfd.[47]	1-10-31	43	47	87½c qu. Jan. 2
California Art Tile A	1- 8-31	2	5½	43¾c qu. Mar. 31
California Art Tile B[50]	1- 8-31	.....	3	20c qu. Mar. 31
Calaveras Cement com.	1- 8-31	.....	12	
Calaveras Cement 7% pfd.	1- 8-31	.....	80	1.75 qu. Jan. 15
Canada Cement com.	1-12-31	12⅝	.....	
Canada Cement pfd.	1-12-31	92	93	1.62½c qu. Dec. 31
Canada Cement 5½'s[43]	1-10-31	99½	.....	
Canada Cr. St. Corp. bonds[43]	1-10-31	91	96	
Certainteed Prod. com.	1-12-31	3¾	4	
Certainteed Prod. pfd.	1-12-31	12½	16½	1.75 qu. Jan. 1
Cleveland Quarries	1-12-31	59	65	75c qu. 25c ex. Dec. 1
Columbia S. & G. pfd.	1-13-31	78	86	
Consol. Cement 1st 6½'s, A	1-13-31	30	40	
Consol. Cement. 6½% notes	1-13-31	30	35	
Consol. Cement pfd.[29]	1-14-31	30	50	
Consol. Oka S. & C. 6½'s[32] (Canada)	1-12-31	99	102	
Consol. Rock Prod. com.[9]	1- 8-31	75c	1	
Consol. Rock Prod. pfd.[9]	1- 8-31	3½	4	43¾c qu. June 1
Consol. Rock Prod. units	1-12-31	7	10	
Consol. S. & G. pfd. (Can.)[43]	1-10-31	78¾	79¾	1.75 qu. Nov. 15
Construction Mat. com.	1-12-31	9¾	10⅞	
Construction Mat. pfd.	1-12-31	28½	30	87½c qu. Feb. 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[44]	1- 8-31	78	83	
Coosa P. C. 1st 6's[20]	1-14-31	45	50	
Coplay Cem. Mfg. 1st 6's[40]	1-10-31	95	.....	
Coplay Cem. Mfg. com.[40]	1-10-31	10	.....	
Coplay Cem. Mfg. pfd.[40]	1-10-31	60	.....	
Dewey P. C. 6's (1930)[30]	1-13-31	99	.....	
Dewey P. C. 6's (1931-37)[30]	1-13-31	99	.....	
Dolese & Shepard	1-12-31	65	70	$2 qu. Jan. 2
Dufferin Pav. & Cr. Stone com.	1-12-31	7½	.....	
Dufferin Pav. & Cr. Stone pfd.	1-12-31	70	.....	1.75 qu. Jan. 2
Edison P. C. com.[30]	1-10-31	50c	.....	
Edison P. C. pfd.[30]	1-10-31	2	.....	
Giant P. C. com.[2]	1-10-31	3	8	
Giant P. C. pfd.[2]	1-10-31	25	.....	1.75 s.-a. Dec. 15
Gyp. Lime & Alabastine, Ltd.	1-12-31	11¾	12	20c qu. Jan. 2
Gyp. Lime & Alab., Ltd., pfd.	11-17-30	.....	15	
Hermitage Cement com.[11]	1-10-31	25	30	
Hermitage Cement pfd.[11]	1-10-31	75	81	
Ideal Cement, new com.	1-12-31	47	49	75c qu. Jan. 1 & 50c ex. Dec. 22
Ideal Cement 5's, 1943	1- 9-31	99½	100⅛	
Indiana Limestone units[20]	1-14-31	80	85	
Indiana Limestone 6's	1-12-31	50	50½	
International Cem. com.	1-12-31	51	51¾	$1 qu. Dec. 31
International Cem. bonds 5's	1-12-31	98	98⅝	Semi-ann. int.
Iron City S. & G. bonds 6's[46]	11- 1-30	90	93	
Kelley Is. L. & T. new stock	1-12-31	34	35	62½c qu. Jan. 2
Ky. Cons. St. com. V.T.C.[48]	1- 8-31	5	8	
Ky. Cons. Stone 6½'s[48]	1- 8-31	85	90	
Ky. Cons. Stone com.[48]	1- 8-31	5	8	
Ky. Cons. Stone pfd.[48]	1- 8-31	75	80	$1.75 qu. Feb. 1
Ky. Rock Asphalt com.[11]	1-10-31	5	7	40c qu. Oct. 1
Ky. Rock Asphalt pfd.[11]	1-10-31	75	83	1.75 qu. Dec. 1
Ky. Rock Asphalt 6½'s[31]	1-10-31	85	95	
Lawrence P. C.[2]	1-10-31	50	55	$1 qu. Dec. 29
Lawrence P. C. 5½'s, 1942[2]	1-10-31	87	.....	
Lehigh P. C.	1-12-31	17	19	25c qu. Feb. 2
Lehigh P. C. pfd.	1-12-31	98½	110	1¾% qu. Jan. 2
Louisville Cement[7]	1- 8-31	150	.....	
Lyman-Richey 1st 6's, 1932[13]	1-10-31	97½	99½	
Lyman-Richey 1st 6's, 1935[13]	1-10-31	97	99	
Marblehead Lime 6's[14]	1- 9-31	No market		
Marbelite Corp. com. (cement products)	11-29-30	.....	3	
Marbelite Corp. pfd.	1- 8-31	5	.....	50c qu. Oct. 10
Material Service Corp.	1-12-31	17½	18½	50c qu. Dec. 1
McCrady-Rogers 7% pfd.[22]	1- 8-31	45	50	87½c qu. Dec. 31
McCrady-Rogers com.[22]	1- 8-31	15	20	
Medusa Portland Cement	1-12-31	65	72	1.50 Jan. 1
Mich. L. & C. com.[6]	12-27-30	40	.....	
Missouri P. C.	1-12-31	26	27	50c qu. & 50c ex. Nov. 1
Monolith Portland Midwest[9]	1- 8-31	1¾	2½	
Monolith bonds, 6's[9]	12-11-30	80	85	
Monolith P. C. com.[9]	1- 8-31	3	4	40c s.-a. Jan. 1
Monolith P. C. pfd.[9]	1- 8-31	4	5	40c s.-a. Jan. 1
Monolith P. C. units[9]	1- 8-31	10	12	
National Cem. (Can.) 1st 7's[43]	1-10-31	98½	100	
National Gypsum A com.	1-12-31	4¼	5¼	
National Gypsum pfd.	1-12-31	30	33	$1, Jan. 2
Nazareth Cement com.[26]	12-12-30	13	.....	
Nazareth Cement pfd.[26]	12-12-30	95	.....	
Newaygo P. C. 1st 6½'s[29]	1-14-31	100½	101	
New Eng. Lime 1st 6's[14]	1- 9-31	No market		
N. Y. Trap Rock 1st 6's	1-13-31	95	96	
N. Y. Trap Rock 7% pfd.[36]	1-10-31	95	.....	1.75 qu. Jan. 2
North Amer. Cem. 1st 6½'s	1-12-31	43¼	44	
North Amer. Cem. com.[51]	1- 9-31	1½	2½	
North Amer. Cem. 7% pfd.[51]	1- 9-31	14	18	
North Shore Mat. 1st 5's[15]	1-13-31	92	.....	
Northwestern States P. C.[37]	12-29-30	105	115	$2 Apr. 1
Ohio River Sand com.	1-12-31	.....	15	
Ohio River Sand 7% pfd.	1-12-31	.....	98	
Ohio River S. & G. 6's[16]	1-10-31	87	90	
Oregon P. C. com.[9]	1- 8-31	9	13	
Oregon P. C. pfd.[9]	1- 8-31	80	90	
Pacific Coast Aggr. com.[50]	1- 8-31	3	6	
Pacific Coast Aggregates pfd.	1-12-31	2	4	
Pacific Coast Cement 6's[5]	1- 8-31	65	75	
Pacific P. C., new com.	1- 8-31	12½	.....	
Pacific P. C., new pfd.	1- 8-31	.....	75	1.62½ qu. Jan. 5
Pacific P. C. 6's[5]	1- 8-31	97½	99	
Peerless Cement com.[1]	1- 9-31	5½	6	
Peerless Cement pfd.[1]	1- 9-31	70	75	1.75 Jan. 1
Penn.-Dixie Cement com.	1-12-31	3½	4¼	
Penn.-Dixie Cement pfd.	1-12-31	23	30	
Penn.-Dixie Cement 6's	1-13-31	70⅛	71	
Penn. Glass Sand Corp. 6's	1- 9-31	100	102	
Penn. Glass Sand Corp. pfd.	1- 9-31	90	.....	1.75 qu. Jan. 1
Petoskey P. C.	1-12-31	5½	7	1½c qu. Apr. 1
Port Stockton Cem. com.[9]	1- 8-31	No market		
Riverside Cement com.	1- 8-31	10	14	
Riverside Cement pfd.[20]	1 -7-31	63	68	1.50 qu. Feb. 1
Riverside Cement, A[20]	1- 7-31	10	14	15c qu. Feb. 1
Riverside Cement, B[20]	1- 7-31	1	.....	
Roquemore Gravel 6½'s[17]	1-10-31	98	100	
Santa Cruz P. C. com.	1- 8-31	85	.....	$1 qu. Jan. 1 & $2 ex. Dec. 24
Schumacher Wallboard com.	1- 8-31	10½	11½	
Schumacher Wallboard pfd.	1- 8-31	16½	22	50c qu. Nov. 15
Southwestern P. C. units[44]	1- 8-31	240	300	
Standard Paving & Mat. (Canada) com.	1-12-31	14¾	15	50c qu. Nov. 15
Standard Paving & Mat. pfd.	1-12-31	.....	80	1.75 qu. Nov. 15
Superior P. C., A	1- 8-31	30¾	37½	27½c mo. Jan. 1
Superior P. C., B	1- 8-31	8¼	10	25c qu. Dec. 20
Trinity P. C. units[37]	12-29-30	105	120	
Trinity P. C. com.[37]	12-29-30	30	.....	
Trinity P. C. pfd.[39]	1-14-31	109	112	
U. S. Gypsum com.	1-12-31	38¾	39½	40c qu. & 50c ex. Dec. 31
U. S. Gypsum pfd.	1-12-31	119	124	1.75 qu. Dec. 31
Warner Co. com.[16]	1-10-31	30	31	50c qu. Jan. 15
Warner Co.1st 7% pfd.[16]	1-10-31	98	100	1.75 qu. Jan. 1
Warner Co. 1st 6's[8]	1-13-31	96	97	
Whitehall Cem. Mfg. com.[36]	1-10-31	80	.....	
Whitehall Cem. Mfg. pfd.[36]	1-10-31	50	.....	
Wisconsin L. & C. 1st 6's[15]	1-13-31	92	.....	
Wolverine P. C. com.	1-12-31	3½	4	15c qu. Nov. 15
Yosemite P. C., A com.[9]	1- 8-31	2	2½	

*See inactive securities below.

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler Reading & Co., Youngstown, Ohio. [5]Smith, Camp & Co., San Francisco, Calif. [6]Frederic H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simon & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [24]A. B. Leach & Co., Inc., Chicago, Ill. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [28]Bank of Republic, Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago, Ill. [33]Boettcher Newton & Co., Denver, Colo. [36]Hanson and Hanson. New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [42]Jones, Heward & Co., Montreal, Que. [44]Tenney, Williams & Co., Los Angeles, Calif. [46]Stein Bros. & Boyce, Baltimore, Md. [47]Wise, Hobbs & Arnold, Boston. [48]E. W. Hays & Co., Louisville, Ky. [49]Blythe Witter & Co., Chicago, Ill. [50]Martin Judge Co., San Francisco, Calif. [51]Hemphill, Noyes & Co., New York City. [52]Nesbitt, Thomson & Co., Montreal.

Annual Report of the Lehigh Cement Company

FOLLOWING are extracts from the report of the president of the Lehigh Portland Cement Co., Allentown, Penn., for the fiscal year ending November 30, 1930:

Net earnings, after provision for depreciation and taxes, were $2,105,993.12, as compared with $2,737,476.78 for the fiscal year ended November 30, 1929. Four quarterly dividends on the preferred stock (including the disbursement paid January 2, 1931) and four quarterly dividends on the common stock (including the disbursement to be paid February 2, 1931) have been deducted from 1930 earnings, resulting in an impairment of $64,856.68 to surplus.

The first two of the four common dividends deducted from earnings for the fiscal period ended November 30, 1930, namely, those paid May 1, 1930, and August 1, 1930, were paid at the rate of $2.50 per year. Because the earnings statement of the company for the twelve months ended August 31, 1930, showed $1,534,478 in net earnings available for dividends on outstanding preferred and common stock, as against $3,676,051 for the twelve months ended August 31, 1929, the quarterly dividend paid November 1, 1930, was reduced from 62½c. per share to 25c. per share. The dividend declared payable February 2, 1931, out of earnings for the fiscal year ended November 30, 1930, is also on the lower basis of $1 per share per year.

After deduction of preferred dividends paid, there were available for dividends on issued common stock $655,638.62, or $1.46 per share, on November 30, 1930, as compared with $1,249,030.03, or $2.77 per share, on November 30, 1929.

There were acquired for cancellation during the year 6222 shares of preferred stock. The number of preferred shares thus far acquired for retirement since the date of issue, February 1, 1928, totals 20,205 shares. The total number of preferred shares required to be retired as of November 30, 1930, under the provisions of issue, was 10,697 shares. The company therefore has set up a credit equivalent to slightly more than 2½ years' sinking fund requirements.

The liquid position of the company is reflected by the items of U. S. Treasury certificates and Liberty Loan bonds $8,556,679.69 and cash $4,854,504.02, making a total of $13,411,183.71.

Four quarterly dividends on the 7% class "A" stock of the Great Lakes Portland Cement Corp. held by the Lehigh company, aggregating $157,500, were received and credited to income.

During the fiscal year 1930, four of the oldest mills of the company were entirely written off the books. One was located at Ormrod, Penn., one at Mitchell, Ind., and two at New Castle, Penn. The above write-off did not reduce surplus for the reason that ample depreciation had been provided over a period of years. Because a reserve for these mills had been fully provided for, the land, buildings, machinery and equipment account was reduced to the extent of $2,808,762.29 and the reserve for depreciation was decreased a like amount. The burden of depreciation as well as repairs and maintenance of these mills is therefore eliminated from future accounting.

During the year there were charged against earnings and added to depreciation reserve $1,994,447.14. Renewals amounting to $266,054.15 were charged against the reserve, leaving a net addition to the depreciation reserve account for the year 1930 of $1,728,392.99. At the close of the year the provision for depreciated property of this company, after writing off the four mills above referred to, was $17,644,315.41.

The earnings of the company for the fiscal year 1930 were again considerably lower than for the fiscal year 1929. This reduction was due in part to severe competition, both foreign and domestic, resulting in lower average prices, and in part to a decrease in the consumption of cement. According to the reports of the Federal Bu-

COMPARATIVE BALANCE SHEET OF THE LEHIGH PORTLAND CEMENT CO.

ASSETS

	1930—November 30—	1929
Property account:		
Land, buildings, machinery and equipment, at cost	$46,418,276.88	$48,501,299.62
Less—Reserve for depreciation	17,644,315.41	18,724,684.71
	$28,773,961.47	$29,776.614.91
Mineral deposits—less depletion	1,670,010.76	1,682,583.18
	$30,443,972.23	$31,459,198.09
Investments and advances:		
Investments in and advances to affiliated companies and subsidiaries not consolidated	$3,109,748.88	$ 2,986,927.41
Workmen's compensation insurance fund invested in U. S. Government obligations	336,723.89	325,343.00
Treasury stock—Common, at par	50,950.00	65,950.00
Miscellaneous stocks and bonds, at cost	75,265.22	84,429.44
	$ 3,572,687.99	$ 3,462,649.85
Current assets:		
Cash	$ 4,854,504.02	$ 3,929,544.84
Demand loans		8,000,000.00
Liberty Loan bonds and U. S. Treasury certificates, at cost	8,556,679.69	1,258,500.00
Working funds and advances	282,295.14	203,569.84
Accounts and bills receivable, less reserves for discounts and doubtful accounts	1,236,325.29	1,277,325.10
Inventories of finished cement, work in process, etc., at cost or market, whichever is lower	2,803,192.85	3,164,487.07
Inventory of machinery parts and supplies at cost	968,259.29	1,039,796.65
	$18,701,256.28	$18,873,223.50
Deferred charges:		
Unabsorbed stripping charges, etc.	$ 1,049,362.10	$ 1,296,082.96
Prepaid insurance	32,876.29	30,918.38
	$ 1,082,238.39	$ 1,327,001.34
	$53,800,154.89	$55,122,072.78

COMPARATIVE BALANCE SHEET OF THE LEHIGH PORTLAND CEMENT CO.

LIABILITIES

	1930—November 30—	1929
Capital stock:		
Preferred—7% cumulative:		
Authorized—300,000 shares of $100 each		
Issued—225,174 shares	$22,517,400.00	$22,517,400.00
Less—Retired and purchased for retirement	2,020,500.00	1,398,300.00
	$20,496,900.00	$21,119,100.00
Common:		
Authorized—600,000 shares of $50 each		
Issued—450,348 shares	$22,517,400.00	$22,517,400.00
Current liabilities:		
Accounts payable	$ 324,836.56	$ 642,678.24
Accrued wages, salaries and general taxes	231,982.77	302,140.06
Reserve for federal income taxes	255,795.14	315,158.85
Dividends payable	470,030.50	650,129.25
	$ 1,282,644.97	$ 1,910,106.40
Reserves:		
Returnable cotton duck bags	$ 59,934.18	$ 152,555.91
Compensation and fire insurance reserves	689,724.04	588,387.32
	$ 749,658.22	$ 740,943.23
Unrealized appreciation arising from appraisal of mineral deposits as at March 1, 1913	$ 394,023.49	$ 410,138.26
Surplus	8,359,528.21	8,424,384.89
	$53,800,154.89	$55,122,072.78

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
American Portland Cement,[3] 100 shs., par $10	$100 for the lot	
American Portland Cement,[3] 400 shs., par $10	$400 for the lot	
American Portland Cement,[3] 100 shs., par $10	$75 for the lot	
Atlantic Gypsum Products 1st 6s, 1941 ($28,000)[2]	$7400 for the lot	
Blue Diamond Materials, 10 shs. pfd.[5]	$10 for the lot	
Florida Portland Cement (Del.),[3] 50 shs. com., no par and 50 pfd.	$450 for the lot	
Florida Portland Cement, 10 shs. pfd. and 5 shs. com.[6]	$100 for the lot	
Indiana Limestone, 200 shs. pfd. and 1000 com., no par[4]	$2000 for the lot	
Rockland and Rockport Lime, 330 shs. pfd., 85 2nd pfd. and 135 com.[10]	$55 for the lot	
Rockland and Rockport Lime Corp., 50 shs. 1st pfd.[11]	$40 for the lot	
Standard Rock Asphalt, 1200 shs. no par stock[4]	1¼	
Tory Hill Sand and Gravel, 13 shs. 8% pfd.[8]	$1 for the lot	
Tory Hill Sand and Gravel, 13 shs. com., no par[8]	$1 for the lot	
United Feldspar, 388 shs. pfd., 647 com.[9]	$1000 for the lot	
Universal Gypsum, 100 trustees cert., no par[7]	$1 for the lot	
Universal Gypsum, 500 shs. com., no par[9]	$12 for the lot	
Universal Gypsum and Lime, 300 shs.[1]	$4 for the lot	
Universal Gypsum and Lime, 200 shs.[1]	$2 for the lot	
Vulcanite Portland Cement, 300 shs. com., no par[8]	$425 for the lot	

[1]Price at auction by Adrian H. Muller & Son, New York, August 6, 1930. [2]Price at auction by Adrian H. Muller & Son, New York City, November 19, 1930. [3]Price at auction by Adrian H. Muller & Son, New York City, December 10, 1930. [4]Price at auction, Adrian H. Muller & Son, December 24, 1930. [5]Price at auction, R. L. Day & Co., Boston, December 17, 1930. [6]Price at auction, Barnes &L ofland, Philadelphia, December 17, 1930. [7]Price at auction, A. J. Wright & Co., Buffalo, December 17, 1930. [8]Price at auction, Adrian H. Muller & Son, December 17, 1930. [9]Price at auction, Adrian H. Muller & Son, December 31, 1930. [10]Price at auction, R. L. Day & Co., December 31, 1930. [11]Price at auction, Wise, Hobbs & Arnold, Boston, December 31, 1930.

COMPARATIVE STATEMENT OF PROFIT AND LOSS OF THE LEHIGH PORTLAND CEMENT CO.

	1930—November 30—1929	
Sales, less discounts, allowances, etc.	$16,699,886.91	$19,346,790.86
Cost of sales:		
Manufacturing and shipping cost	$ 9,775,382.23	$11,168,759.26
Provision for depreciation, obsolescence and accrued renewals	2,026,634.36	2,292,204.78
Total cost of sales	$11,802,016.59	$13,460,964.04
Manufacturing profit	$ 4,897,870.32	$ 5,885,826.82
Selling, administrative and general expenses	3,049,503.77	3,569,781.55
Net profit from operations	$ 1,848,366.55	$ 2,316,045.27
Miscellaneous income	514,910.77	736,590.36
Total income	$ 2,363,277.32	$ 3,052,635.63
Provision for federal income taxes	257,284.20	315,158.85
Net income for the year carried to surplus account	$ 2,105,993.12	$ 2,737,476.78

SURPLUS ACCOUNT, NOVEMBER 30, 1930

Balance at November 30, 1929		$ 8,424,384.89
Add:		
Net income for the year ending November 30, 1930	2,105,993.12	
Adjustment of unrealized appreciation for stone removed	16,114.77	
Federal income tax refund covering the fiscal years 1921-1924	77,898.03	
		$10,624,390.81
Deduct:		
Cash dividends:		
On preferred stock	$ 1,450,354.50	
On common stock	786,160.10	
Premium paid on 6222 shares of 7% cumulative preferred stock retired	28,348.00	
		2,264,862.60
Surplus carried to balance sheet		$ 8,359,528.21

reau of Mines, the total consumption of cement in the United States for the fiscal year ended November 30, 1929, was approximately 3,500,000 bbl. less than for the corresponding 1928 period. For the twelve months ended November 30, 1930, these reports show a further and more marked shrinkage of approximately 11,863,000 bbl. as against the consumption of the corresponding period in 1929.

A duty on cement of 6c. per 100 lb. or 23c. per bbl. is included in the Hawley-Smoot Tariff Bill. While this limited measure of protection is helpful, the rate is nevertheless not sufficient to enable domestic cement manufacturers to sell with profit in competition with foreign cement at seaboard points.

The cement industry has been going through a period of severe strain. During the past four years new plants have been built and old plants have been remodeled to increase capacity. In 1926 the total annual capacity of all plants then operating in the United States was 215,300,000 bbl. The total shipments in 1926 were 162,200,000 bbl. The excess cement capacity in the country in 1926 was therefore approximately 32%. In 1929 the total annual capacity of all plants then operating in the United States was 259,300,000. The total shipments in 1929 were 169,900,000 bbl. The excess cement capacity in the country in 1929 was therefore approximately 52%. The cement industry has suffered the fate of many others in that capacity has been increased to a point where potential production is out of all proportion to present market requirements.

The plants of the company are in good physical condition. Liberal expenditures have been made during the year to install new machinery and equipment designed to reduce cost and improve quality.

The cement manufactured at all mills of the company was marketed during the whole of 1930 on the new and more exacting specifications which became officially effective September 1, 1930. During the entire year not one barrel of "Lehigh" cement was rejected.

The safety record of the company is outstanding. Four plants operated without a lost-time accident in 1929. These plants were awarded the much coveted trophies of the Portland Cement Association for 100% safety performance. This year no less than eight of the fourteen plants in operation have come through without mishap.

As against this record for the past two years the figures of former years present a striking comparison. Whereas in the years closely following the World War, when industrial safety was considered largely as an experiment, the average fatal accidents numbered 8 per year and the days lost due to accidents totaled 5227 per year, in 1930 there were but 3 fatal accidents and the total days lost due to accidents numbered only 271. From 1918 to 1922 the company averaged 351 lost-time accidents per year. In 1930 there were only 14 such accidents. This marked improvement in safety performance has resulted not only in increasing the morale of the men at the plants but also in decreasing the economic loss flowing from accidents.

The Iola, Kan., plant of the company has operated from September 9, 1926, to date without a lost-time accident. This plant now leads all others in the country in safety performance.

This year the Joseph A. Holmes Safety Association awarded the Lehigh Portland Cement Co. a Certificate of Honor for its exceptionally good safety record from 1924 to 1929. This is the highest award in safety ever made to a cement company.

The road programs of many states will require large quantities of cement during the coming year. General building operations will probably be on a restricted basis. However, the U. S. Government work is likely to be quite active and may compensate for a shrinkage in the use of cement in building and other operations. On the whole the prospects are good, particularly when present business and financial conditions are taken into consideration.

Westchester County, New York, Gravel Companies Merge

A MERGER of the Yonkers Sand and Gravel Co., Yonkers, N. Y., the Cooney Sand and Gravel Co. and the F. A. Ottman and Sons Co., of New Rochelle, N. Y., to be known as the County Sand and Stone Co., has been completed. It was later incorporated for $850,000.

Recent Dividends Announced by Companies in Rock Products Industries

Arundel Corp. (qu.)	$0.75	Jan. 2
Boston Sand and Gravel com. (qu.)	0.40	Jan. 2
Boston Sand and Gravel pfd. (qu.)	0.87½	Jan. 2
Calaveras Cement pfd. (qu.)	1.75	Jan. 15
Construction Materials pfd. (qu.)	0.87½	Feb. 1
Dolese and Shepard (qu.)	2.00	Jan. 2
Dufferin Pav. and Crushed Stone, Ltd., pfd. (qu.)	1.75	Jan. 2
Gypsum Lime and Alabastine, Ltd. (qu.)	0.20	Jan. 2
Kelley Island Lime and Transport (qu.)	0.62½	Jan. 2
Kentucky Cons. Stone pfd. (qu.)	1.75	Feb. 1
Lawrence Portland Cement (qu.)	1.00	Dec. 29
Limestone Products pfd. (qu.)	0.62½	Apr. 1
McCrady-Rodgers pfd. (qu.)	0.87½	Dec. 31
Medusa Portland Cement com. (qu.)	1.50	Jan. 1
Medusa Portland Cement pfd. (qu.)	1.50	Jan. 1
National Gypsum pfd.	1.00	Jan. 2
Newaygo Portland Cement pfd. (qu.)	1.75	Jan. 1
New York Trap Rock pfd. (qu.)	1.75	Jan. 2
Pacific Portland Cement pfd. (qu.)	1.62½	Jan. 5
Peerless Cement pfd. (qu.)	1.75	Jan. 1
Riverside Cement pfd. (qu.)	1.50	Feb. 1
Riverside Cement A (qu.)	0.15	Feb. 1
Santa Cruz Portland Cement com. (qu.)	1.00	Jan. 1
Santa Cruz Portland Cement extra	2.00	Dec. 24

Cement Companies Paid Christmas Bonuses

ACCORDING to numerous newspaper reports several portland cement manufacturers paid substantial Christmas bonuses to employes. Among these are found: Dewey Portland Cement Co., employes of five years or more, 7% of total earnings for the year; four years, 6%; three years, 5%; two years, 4%, and one year 3%. Northwestern States Portland Cement Co., a total of $30,000 to 350 employes. Medusa Portland Cement Co., 2% of the annual earnings of all employes.

Sand and Gravel Production in 1929

BOTH THE QUANTITY AND VALUE of sand and gravel reported by producers in the United States for 1929 showed gains over any preceding year, according to statistics just made available by the United States Bureau of Mines, Department of Commerce. The total production for 1929 is reported at 222,571,905 short tons, a gain of 6.4% over the preceding year. A decline in the production of structural sand and gravel in comparison with 1928 was apparently more than offset by increases reported for paving and road-making and for railroad ballast.

The total value of all sand and gravel produced in 1929 was $132,835,979 f.o.b. plant, an increase of 11.4% over 1928, and the highest figure since the beginning of the statistical record.

Because sand and gravel are commodities of relatively low specific value per unit of weight, available sources of supply are generally developed as close to markets and points of consumption as practicable. Hence the production of sand and gravel is widespread throughout the country, no state being without some phase of the industry. The production attained in a given locality, however, is directly related to the structural and industrial requirements of the area. New York and Illinois, with outputs of 21,061,094 and 18,256,203 tons, respectively, were the largest producers in 1929. Other states producing more than 10,000,000 tons are as follows in the order of quantity produced: Michigan, California, Ohio, Pennsylvania, Indiana and Wisconsin. New York and Pennsylvania led the states in total value of production in 1929.

About 76% of the total output of sand and gravel was reported as washed and screened. Detailed figures on the production and value of sand and gravel in 1929 are given in the two tables herewith.

SAND AND GRAVEL SOLD OR USED BY PRODUCERS IN THE UNITED STATES IN 1929, BY STATES

State	Short tons	Value
Alabama	2,371,545	$ 1,229,424
Arizona	395,386	329,116
Arkansas	3,992,336	1,851,755
California	15,688,545	8,371,263
Colorado	982,866	492,587
Connecticut	850,390	566,410
Delaware	78,055	59,266
District of Columbia	(*)	(*)
Florida	788,298	422,409
Georgia	604,611	235,299
Idaho	661,993	243,173
Illinois	18,256,203	9,071,238
Indiana	10,901,798	5,528,832
Iowa	4,043,609	2,211,752
Kansas	3,389,783	1,879,899
Kentucky	2,350,430	1,581,501
Louisiana	3,138,673	2,069,024
Maine	2,861,271	447,140
Maryland	3,193,486	2,853,617
Massachusetts	5,114,188	3,503,576
Michigan	16,844,099	7,928,744
Minnesota	4,990,256	2,412,776
Mississippi	2,766,036	1,277,746
Missouri	5,775,729	4,291,164
Montana	2,446,422	667,827
Nebraska	3,370,513	1,857,065
Nevada	1,403,255	605,079
New Hampshire	1,976,781	1,223,371
New Jersey	6,721,498	5,585,285
New Mexico	337,768	177,368
New York	21,061,094	14,919,658
North Carolina	1,004,858	1,020,533
North Dakota	493,411	133,621
Ohio	14,250,141	9,182,862
Oklahoma	2,904,897	1,612,755
Oregon	2,257,338	1,508,787
Pennsylvania	12,674,320	13,658,328
Rhode Island	301,533	154,390
South Carolina	1,068,005	602,432
South Dakota	2,729,271	578,204
Tennessee	3,089,500	2,086,535
Texas	9,409,295	5,765,943
Utah	1,588,305	722,971
Vermont	170,301	58,879
Virginia	1,728,590	1,165,358
Washington	5,391,693	2,138,019
West Virginia	2,667,940	2,893,542
Wisconsin	10,727,632	4,574,182
Wyoming	(*)	(*)
Undistributed†	2,757,958	1,085,274
Total	222,571,905	$132,835,979

*Included in "Undistributed."
†Includes District of Columbia and Wyoming.

William A. Kelly

IT IS WITH REGRET that we announce the death of William A. Kelly, superintendent of the Monocacy operations of the John T. Dyer Quarry Co. Mr. Kelly died on January 7, 1931, from pneumonia after a short illness.

Wm. A. Kelly

Mr. Kelly was in charge of the Monocacy, Penn., plant for many years and perhaps was one of the best known plant superintendents in the East, especially in Pennsylvania, for while Mr. Kelly was in charge of the Monocacy plant he materially assisted in the development of many new quarry and plant practices which today are universally used in the industry. His death is a distinct loss to the industry and to his employer and host of friends.

Annis W. Clem

ANNIS W. CLEM, 72, resident of Dallas, Tex., since 1889, former city councilman for six years, vice-president of the Clem Gravel Co. which he founded, and it is said the first man to ship gravel over railroads in Texas, died at a Dallas hospital December 13.

Mr. Clem came to Texas from Arkansas in 1889, locating in Dallas. Shortly after that he organized the Clem Oil Co.

In order to make good his word for an order of gravel, Mr. Clem then organized the Clem Gravel Co., which he operated until his death.

Mr. Clem was born September 21, 1858. Surviving are his wife, Mrs. Felecia B. Clem; three sons, Henry H., Winfield and Eugene H. Clem; one daughter, Mrs. J. R. Davidson, and one stepdaughter, Miss Romona Rees, all of Dallas.

He was a member of the Knights of Pythias, the Lions' Club and the Dallas Chamber of Commerce. For some time he lived west of the river before Oak Cliff became a part of Dallas, and was considered one of "Oak Cliff's dads."—*Dallas* (Tex.) *News*.

Herbert M. Halverson

HERBERT M. HALVERSON, 38, president of the Waukesha Lime and Stone Co., Waukesha, Wis., shot himself December 10, in a Milwaukee garage.

Mr. Halverson had been associated with the Waukesha Stone Co. for 17 years, the last two and a half as president. He also was a director on the board of the First State bank of Waukesha.

A reorganization of the stone company was announced recently with Mrs. M. O'Laughlin Gillen as the new president and general manager. She is the daughter of John O'Laughlin, who founded the concern in 1905, and was for many years its president.

H. S. Willingham

HAROLD S. WILLINGHAM, 49, president of the Willingham-Little Stone Co., Marietta, Ga., operating three plants at Whitestone, Ga., with headquarters in Atlanta, died at his home, January 2, following a short illness.

Mr. Willingham was one of the best known crushed stone men in Georgia. He specialized in special aggregates for terrazzo, concrete products and stucco. He was an active director of the Merchants and Farmers Bank at Marietta, and also owned and operated a number of large farms in Georgia successfully. His widow, one daughter and three sons survive.

SAND AND GRAVEL SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1928-1929

	1928		1929	
	Short tons	Value	Short tons	Value
Sand:				
Glass	2,310,828	$ 3,435,645	2,219,677	$ 3,788,471
Molding	4,781,765	5,089,969	6,195,343	6,410,343
Building	45,629,207	24,116,772	41,161,013	23,309,238
Paving	35,244,544	17,305,750	40,801,991	21,131,731
Cutting, grinding and blast	1,538,046	1,991,962	1,636,464	2,303,652
Fire or furnace	305,659	362,044	440,679	483,551
Engine	2,413,043	1,544,204	2,318,931	1,487,906
Filter	113,978	226,896	100,081	199,838
Other*	5,400,647	2,059,164	4,378,875	1,686,627
	97,737,717	$ 56,132,406	99,253,054	$ 60,801,357
Gravel:				
Building	34,747,235	$ 24,071,208	32,448,800	$ 23,813,885
Paving	49,088,786	30,697,993	60,029,164	38,695,207
Railroad ballast†	27,545,130	8,306,330	30,840,887	9,525,530
	111,381,151	63,075,531	123,318,851	72,034,622
Grand total	209,118,868	$119,207,937	222,571,905	$132,835,979

*Includes some sand used for railroad ballast and fills.
†Includes some gravel used for fills by railroads and others.

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended Nov. 29	Limestone Flux Week ended Dec. 6	Sand, Stone and Gravel Week ended Nov. 29	Sand, Stone and Gravel Week ended Dec. 6
Eastern	1,417	1,461	2,691	1,930
Allegheny	1,330	1,496	2,741	2,450
Pocahontas	180	111	863	742
Southern	456	450	6,848	6,806
Northwestern	614	508	1,892	1,034
Central Western	371	487	4,328	4,553
Southwestern	329	299	4,247	3,878
Total	4,697	4,812	23,610	21,393

District	Limestone Flux Week ended Dec. 13	Limestone Flux Week ended Dec. 20	Sand, Stone and Gravel Week ended Dec. 13	Sand, Stone and Gravel Week ended Dec. 20
Eastern	1,338	1,079	2,063	1,505
Allegheny	1,337	1,259	2,515	1,909
Pocahontas	178	79	764	515
Southern	356	401	7,284	5,047
Northwestern	518	415	1,551	1,032
Central Western	424	454	4,672	3,803
Southwestern	408	343	4,171	3,328
Total	4,559	4,030	23,020	17,139

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1929 AND 1930

District	Limestone Flux 1929 Period to date Dec. 21	Limestone Flux 1930 Period to date Dec. 20	Sand, Stone and Gravel 1929 Period to date Dec. 21	Sand, Stone and Gravel 1930 Period to date Dec. 20
Eastern	164,159	136,630	551,526	391,865
Allegheny	176,864	129,615	364,834	303,436
Pocahontas	18,794	21,435	50,082	62,251
Southern	30,866	30,594	438,014	409,350
Northwestern	54,829	48,863	303,415	259,984
Central Western	26,624	24,414	526,917	469,641
Southwestern	25,330	22,293	345,895	314,601
Total	497,466	413,844	2,580,683	2,211,128

COMPARATIVE TOTAL LOADINGS, 1929 AND 1930

	1929	1930
Limestone flux	*497,466*	*413,844*
Sand, stone, gravel	*2,580,683*	*2,211,128*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week of January 10:

SOUTHERN FREIGHT ASSOCIATION DOCKET

52974. **Crushed stone,** from Harpers Siding, Va., to N. & W. Ry. stations, Saltville and Abingdon branches. It is proposed to revise the rates on crushed stone (except bituminous rock and bituminous asphalt rock), carloads (See Note 3), from Harpers Siding, Va., to N. & W. Ry. stations, Saltville and Abingdon branches on basis of I. C. C. Docket 15216 (Buckland Joint Scale). Statement of the present and proposed rates will be furnished upon request.

52975. **Crushed stone,** from Mascot and Strawberry Plains, Tenn., to N. & W. Ry. stations in Virginia. It is proposed to revise the rates on crushed stone (except bituminous asphalt rock), carloads (See Note 3), from Mascot and Strawberry Plains, Tenn., to N. & W. Ry. stations in Virginia on basis of I. C. C. Docket 15216 (Buckland) Scale. Statement of the present and proposed rates will be furnished upon request.

52992. **Stone, crushed,** Big Stone Gap, Glenita and Harpers Siding, Va., to N. & W. Ry. stations. It is proposed to establish rates on crushed stone (except bituminous rock or bituminous asphalt rock), carloads (See Note 3), from Big Stone Gap, Glenita and Harpers Siding, Va., to N. & W. Ry. (Pocahontas and Radford Divisions) stations to reflect the Buckland joint line scale, I. C. C. Docket 15216. Statement of the present and proposed rates will be furnished upon request.

53165. **Lime,** from Fletcher, N. C., to D. & W. stations. At present combination rates apply. It is proposed to establish rates on (A) lime, common, hydrated, quick or slaked, in bulk or in packages, as provided for carload shipments in Southern Classification, minimum weight 30,000 lb.; (B) lime, common, hydrated or slaked, carloads, minimum weight 50,000 lb., from Fletcher, N. C., to D. & W. Ry. stations in line with rates in effect to D. & W. Ry. stations from other kilns. Statement of the proposed rates will be furnished upon request.

53172. **Sand, silica,** Ottawa, Ill., to Georgia and Alabama points and Franklin, Tenn. It is proposed to establish Evansville, Ind., combination, as a through rate for application via usual available routes, on washed or processed silica sand, carloads (See Note 3), from Ottawa, Ill., to the following destinations: Anniston, Ala., Marietta, Ga., $4.40; Ball Ground, Ga., Canton, Ga., Nelson, Ga., Tate, Ga., $4.50; Bessemer, Birmingham, Ensley, Fairfield, Ala., $4.25; Boyles, Ala., North Birmingham, Ala., Tarrant, Ala., $4.15; Columbus, Ga., $4.55; Franklin, Tenn., $3.70; Gantt's Quarry, Ala., $4.35; East Birmingham, Ala., Rome, Ga., $4.30 per net ton.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

53183. **Cement,** from S. F. A. points to Alexandria, Ala. It is proposed to revise the present rates on cement, carloads, as published in Agent Glenn's Tariff 441-D, I. C. C. No. A-718, from origins named in the tariff to Alexandria, Ala., to reflect the mileage basis as shown in Item 255 of the tariff.

53204. **Stone, marble, calcite, limestone, slate or whitestone,** from Mineral Bluff, Cartersville, Fairmount, Bolivar and Whitestone, Ga., Brownson and Gantt's Quarry, Ala., Kinsey, N. C., Tellico Plains, Louisville, Marmor and Pinkmar, Tenn., to points in Buffalo-Pittsburgh territory. It is proposed to extend the application of the rates now published to Pittsburgh, Penn., only, to also apply to all points in Item 270 of Agent Glenn's Tariff 10-C, I. C. C. A-745. Statement of the proposed rates will be furnished upon request.

53211. **Lime,** from Leeds, North Birmingham and Phoenixville, Ala., to Southern points. It is proposed to revise the rates on lime, carloads, minimum weight 30,000 and 50,000 lb. from Leeds, North Birmingham and Phoenixville, Ala., to points of destination to which rates are presently published in Agent Glenn's I. C. C. A-684 from Alabama Group as follows: Apply Alabama Group point rates to points over 100 miles from Leeds, North Birmingham and Phoenixville. To points less than 100 miles, to which rates are presently published from Alabama Group, the scale shown in Section 8 of Agent Glenn's A-684 for actual distance from each point.

53228. **Stone, crushed,** from Klotz, Va., to Southern Ry. stations in Virginia and North Carolina. It is proposed to establish rates on crushed stone, carloads, from Klotz, Va., to Southern Ry. stations in Virginia and North Carolina on basis of joint scale prescribed by Interstate Commerce Commission in Docket No. 17517, distances to be constructed over Altavista, Virso or Suffolk, Va. Statement of present and proposed rates will be furnished upon request.

53229. **Limestone or marble, ground or pulverized,** from Knoxville, Mascot and Strawberry Plains, Tenn., to Monticello, Miss. It is proposed to cancel, on the obsolete theory, the present rate of $4.62 per net ton on limestone or marble, ground or pulverized, carloads, minimum weight 30 net tons, from and to the above named points. Lowest combination to apply after cancellation.

53251. **Lime,** from Burns, Sherwood and Summitville, Tenn., to Plasterco and Saltville, Va. It is proposed to establish the following rates on lime, carloads, as described in Descriptions "A" and "B" of Agent Glenn's I. C. C. A684. For comparisons present rates are also shown to Plasterco and Saltville, Va. Rates in cents per net ton:

From	Present A	Present B	Proposed A	Proposed B
Burns, Tenn.	400	320	380	304
Sherwood, Tenn.	380	304	350	280
Summitville, Tenn.	380	304	360	288

53152. **Crushed stone and slag,** from Rocky Point, Indian Rock, Eagle Mountain, Longdale and Fishersville, Va., to Southern Ry. stations in Virginia. Submittal No. 53152, included in Docket No. 1553, amended to include Fisherville, Va., as a point of origin, on basis of Trunk Line Scale prescribed by the commission in Docket 17517.

53254. **Sand, gravel, clay gravel, crushed stone and slag,** between stations G. S. W. & G. R. R., on the one hand, and carriers within the state of Georgia on the other, on intrastate traffic. It is proposed to establish the main line or trunk line basis of rates on sand, gravel (washed or unwashed), clay gravel, crushed stone and slag, carloads, between G. S. W. & G. stations and between G. S. W. & G. stations and standard lines in Georgia, in accordance with the scale of rates provided in Agent Glenn's I. C. C. A716, Sup. 8, under Section 3. Note A.

53256. **Limestone poultry grits,** between points in Southern Freight Association territory. It is proposed to establish rates on limestone poultry grits, in bags, carloads, minimum weight 50,000 lb., between points in Southern Freight Association territory, on basis of 15% of current first class rates.

53274. **Slag, basic,** less than carloads, between points in South Carolina—Intrastate. It is proposed to establish rates on ground basic slag, less-carload, between points in South Carolina on basis of the present less-carload fertilizer rates published in Agent Glenn's Fertilizer Tariff, I. C. C. A-746.

53280. **Fluxing stone,** from Sherwood, Tenn., to Alabama City, Ala. Present rates, 130c per net ton. Proposed rate on fluxing stone, carloads (See Note 3), from Sherwood, Tenn., to Alabama City, Ala., 100c per net ton.

53284. **Limestone, ground or pulverized,** Jefferson City, Tenn., to points in Southern Freight Association territory. It is proposed to establish rates on ground or pulverized limestone, carloads, from Jefferson City, Tenn., to all destinations to which rates are published in Southern Railway Limestone Tariff No. 7, I. C. C. A-10119 the same rates as are now applicable from Mascot, Tenn.

SOUTHWESTERN FREIGHT BUREAU DOCKET

21767. **Cement,** from Kansas and Texas points to Louisiana points. To establish the following rates in cents per 100 lb. on cement, carloads, description and minimum weight as per S. W. L. Tariff 168-A, from and to points shown below:

From Atco, Tex., to L. & A. stations, S. W. L. 168-A:
Norco, La., Index 4320, to Shrewsbury, La., Index 4345 — 23½
Three Oaks, La., Index 4350, to New Orleans, La., Index 4355 — 24

Y. & M. V. stations, S. W. L. 169-A:
Good Hope, Ind., Index 10025, to St. Rose, Ind., Index 10035 — 23½
Kenner, La., Index 10215, to Shrewsbury, La., Index 10222 (not shown) — 23½
New Orleans, La., Index 10225 — 24

I. C. stations, S. W. L. 169-A:
Napton, La., Index 2876 (not shown), to Shrewsbury, La., Index 2896 (not shown) — 23½
New Orleans, La., Index 2900 — 24

From (S.W.L. 168-A) Ft.Worth and North Ft. Worth, Tex., to
Gramercy, La., Index 4300 — 22
Garyville, La., Index 4305 — 22

From (S. W. L. 169-A) Kansas Gas Belt points to
Kenner, La., Index 2895 — 29½

Rates in S. W. L. Tariffs 168-A and 169-A are based on I. C. C. Docket 16845 scale and a check of these two tariffs has developed the fact that the rates shown above are off basis.

21772. **Lime,** from Texas points to New Orleans, La. To establish a rate of 16.4c per 100 lb. on

lime, carloads, minimum weight 50,000 lb., from New Braunfels, Dittlinger, Austin, McNeil, Greens Bayou and other Texas producing points, to New Orleans, La. Rates from the Southeast to New Orleans on a minimum of 50,000 lb. are based 80% of the rate authorized under a minimum of 30,000 lb., and the shippers are of the opinion that if this basis is proper from the Southeast, it should not be exceeded from producing points in the Southwest.

21785. **Lime,** from points on N. C. & St. L. Ry. to points in the Southwest. It is proposed to add the following notes in connection with the rates on lime, carload, from producing points on the N. C. & St. L. Ry. to destinations in Arkansas, Louisiana (west of the Mississippi river), Oklahoma and Texas:

Stopping in transit to partly unload.

Applicable only on traffic destined points in Arkansas, Louisiana (west of Mississippi river), Oklahoma and Texas. Carload shipments of lime may be waybilled allowing one stop at intermediate points west of Mississippi river, to partly unload, at charge of $6.30 per car for such stop.

Bills of lading and waybills will show points at which shipments are to be stopped to partly unload and will also show name of party or parties to be notified at such stopping points. Unless this information is furnished, stopover privileges will not be allowed.

Note B—Applicable only on traffic originating at the following N. C. & St. L. producing points: Chattanooga, Burns, Jasper, Sherwood, Summitville, Tenn., and Cumberland, Ala.

The Missouri Pacific R. R. Co. has recently published in connection with the rates on lime, carloads, from Limedale Spur and Ruddells, Ark., to points in Arkansas, etc., a privilege of partial unloading at intermediate points at a charge of $6.30 per car for such stop. Producers at points on the N. C. & St. L. Ry. assert that a failure to obtain the same privilege will place them at a substantial disadvantage and are proposing that the privilege be accorded only at points in southwestern territory in order to meet the actual competition.

21786. **Limestone,** from Glencoe, Mo., to points in Missouri. To amend Item 1105-F, W. T. L. Tariff 91-F, applying on limestone, agricultural (for land fertilization purposes only), carloads, between points in Missouri, by including therein Glencoe, Mo., a local point on the Mo. Pac. R. R., as a point of origin. Plant was recently established at Glencoe, Mo., and is now in readiness to make carload shipments. The shipper contends that the present rates are prohibitive and asks that Glencoe, Mo., be placed on the same basis as Hannibal, Mosher and River Mines, and other points in Item 1105-F with which he has to compete.

21787. **Lime,** from Mosher and Ste. Genevieve, Mo., to Wisconsin Dam, Wis. To establish on lime, carloads, from Mosher and Ste. Genevieve, Mo., to Wisconsin Dam, Wis., a rate of 26c per 100 lb., minimum weight 30,000 lb., and 24½c per 100 lb., minimum weight 60,000 lb. It is desired to establish rates from Mosher and Ste. Genevieve, Mo., on the usual differential over Hannibal, Mo., namely, 2c.

21794. **Keene's cement,** from Blue Rapids, Kan., to New York, N. Y. To establish on Keene's cement and Keene's filler, carloads; and Keene's cement and wall plaster, in mixed carloads; minimum weight 60,000 lb., from Blue Rapids, Kan., to New York, N. Y., a rate of 32½c per 100 lb. Rate includes dock delivery only. Marine insurance to be assumed by the shipper. The proposed rate is published from Medicine Lodge, Kan., in A. T. & S. F. Ry. Tariff 13660A. Shippers at Blue Rapids, Kan., find it necessary to move some of the cement from Blue Rapids, and have requested the establishment of the Medicine Lodge rate.

21799. **Cement,** from Tulsa, Okla., to points in Alabama, Arkansas, Louisiana, etc. To establish on cement, hydraulic, natural or portland, in straight or mixed carloads, minimum weight 50,000 lb., subject to marked capacity of car, but not less than 40,000 lb. (orders for cars of less than 50,000 lb. will not be accepted by the carrier), from Tulsa, Okla., to points in Alabama, Arkansas, Kentucky, Louisiana, Mississippi and Tennessee as per S. W. L. Tariffs 168A and 169A, the Scale III rates as per I. C. C. Docket 16845 or, in other words, the same scale of rates as currently published from Ada, Okla., to these same destinations. Shippers contemplate the erection of a cement plant at Tulsa. At the present time there are generally no through commodity rates on cement from Tulsa to the above named states.

21809. **Cement,** from Tulsa, Okla., to points in Oklahoma. On cement, hydraulic, natural or portland, in straight or mixed carloads, minimum weight 50,000 lb. (except that where maximum capacity of the car used is less, the actual weight, but not less than 40,000 lb., will apply); orders for cars less than 50,000 lb. not to be accepted by carriers—to establish through rates from Tulsa, Okla., to stations in Oklahoma on basis of Scale III to Scale III territory, and the average of Scales III and IV to Scale IV territory.

Scale III to apply in the following territory: Oklahoma—On the east of the A. T. & S. F. Ry., extending from Anthony, Kan., across the Missouri-Oklahoma line to Medford, Okla., thence on and east of the C. R. I. & P. Ry., from Medford through Enid, El Reno, Chickasha and Waurika to the Texas border.

Average of Scale III-IV to apply in the following territory: Oklahoma—West of the line described above. A cement plant is to be constructed at Tulsa, Okla. The above contemplates the application of the same scheme of rates as now apply from Ada, Okla.

21801. **Limestone,** from White Cliffs, Ark., to New York, N. Y. It is proposed to cancel rate of 30c per 100 lb. currently applicable in K. C. S. Ry. Tariff 2857E, and other individual lines' issues, on limestone, crushed or ground, carloads, from White Cliffs, Ark., to New York, N. Y. (via Gulf), allowing the combination rates to apply. Shippers state that there has been no movement of this commodity for the past six years, nor is there a contemplated movement, and it is thought that the rate may be cancelled from the tariff.

21819. **Cement,** from Tulsa, Okla., to points in Texas. To establish on cement, hydraulic, natural or portland, in straight or mixed carloads, minimum weight 50,000 lb., except that where the marked capacity of car used is less, actual weight but not less than 40,000 lb. will apply, through commodity rates from Tulsa, Okla., to Texas; to stations in Scale III territory on basis of Scale III rates and to Scale IV territory Scale IV rates. Rates to apply to same territory as covered by I. C. C. Dockets 15151 and 20821.

Shipper contemplates the erection of a cement plant at Tulsa, Okla. At the present time there are no commodity rates published from Tulsa, Okla., to Texas, and it is shippers' desire to have scale of rates established from Tulsa, Okla., applying same scheme as used in publishing rates from Ada, Okla., to these destination as in I. C. C. Docket 15151 and I. C. C. Docket 20821.

21829. **Crushed rock asphalt,** from Dougherty, Okla., to points in Oklahoma and Texas. To establish on crushed rock asphalt, carloads (See Note 1), except when car is loaded to full visible capacity actual weight will govern, from Dougherty, Okla., to points shown below, and to points on the G. C. & S. F. Ry., single-line rates shown in Item 2763, Texas Lines' Tariff 2-K, and to points on connecting lines of the G. C. & S. F. Ry., who desire to participate in the joint line rates shown in that item (rates in cents per ton of 2000 lb.):

From Dougherty, Okla., to points in Oklahoma

To	Rate	To	Rate
Shattuck	197	Touzalin	197

From Dougherty, Okla., to points in Texas

To	Rate	To	Rate
Magoun	197	Southland	299
Follett	217	Buenos	299
Sherlock	217	Dugger	281
Darrouzett	217	Cap Rock	281
Gaylord	217	Post	281
Booker	217	Augustus	281
Huntoon	217	Justiceburg	281
Twitchell	217	Cow Spur	281
Perryton	217	Sand Creek Spur	281
Lord	217	Eppler	281
Farnsworth	237	Fullerville	281
Waka	237	Dermott	281
Spearman	237	Brand	281
Higgins	197	Snyder	263
Coburn	217	Chorn	263
Glazier	217	Hermleigh	263
Clear Creek	217	Pyron	263
Canadian River Spur	217	Bernecker	263
Canadian	217	Cannon	263
Isaacs	217	Sweetwater	263
Mendota	217	Ranchland	220
Lora	217	Odell	220
Miami	217	Chilicothe	263
Codman	237	Medicine Mound	263
Hoover	237	Graveland	263
Chanesa	237	Margaret	263
Pampa	237	Crowell	263
Heaton	237	Foard City	263
Laketon	237	Truscott	263
Thorndike	237	Benjamin	263
Mobeetie	237	Knox City	263
Briscoe	237	O'Brien	263
Allison	217	Rochester	263
Kingsmill	237	Rule	263
White Deer	237	Sagerton	263
Cuyler	237	Hamlin	263
Panhandle	237	Plasterco	263
Lee	257	McCaulley	263
St. Francis	257	Sylvester	263
Folsom	257	Longworth	263
Amarillo	297	Paret	263
Zita	297	Skellytown	237
Haney	297	Abell	257
Canyon	297	Pomeroy	257
Lester	297	McBride	257
Umbarger	297	Farish	257
Dawn	297	Hillard	257
Joel	297	Borger	257
Hereford	297	Lider	297
Summerfield	297	Aiken	297
Black	297	Lockney	297
Friona	297	Muncy	297
Farmerton	297	Floydada	297
Bovina	297	Hettler	299
Wilsey	297	Idalou	299
Farwell	297	Lorenzo	317
Lariat	297	Ralls	317
Muleshoe	297	Crosbyton	317
Mill	317	Doud	299
Sudan	317	Wolfforth	299
Amherst	317	Balch	299
Littlefield	317	Ropes	317
Bainer	317	Meadow	317
Anton	317	Challis	317
Roundup	317	Brownfield	317
Shallowater	317	Lahey	317
Broadview	317	Wellman	317
Cleta	299	Seagraves	317
Ogg	299	Lisle	299
Happy	299	Hurlwood	299
Kaffir	299	Smyer	317
Tulia	299	Opdyke	317
Eunice	299	Levelland	317
Kress	299	Whiteface	317
Finney	299	Parley	317
Plainview	299	Lehman	317
Ferguson	299	Haven	317
Hale Center	299	Bledsoe	317
Swastika	299	Lofton	299
Alley	299	Wilson	299
Abernathy	299	Dune	299
Monroe	299	Tahoka	299
Marnels	299	Skeen	299
Lubbock	299	O'Donnell	317
Burris	299	Hindman	317
Posey	299	Arvana	317
Slaton	299	Lamesa	317

Shippers of asphalt rock located at Dougherty, Okla., are at a disadvantage because of rates enjoyed to the territory involved by shippers in the Uvalde, Tex., district. The rates proposed are practically the same for similar distances as from points in the Uvalde district. A slight deviation from the Texas intrastate scale has been found necessary at a few points on the P. & S. F. Ry.

21834. **Cement,** from Tulsa, Okla., to Missouri points. To establish on cement, hydraulic, natural or portland, in straight or mixed carloads, minimum weight 50,000 lb., except that when marked capacity of car used is less the actual weight but not less than 40,000 lb. will apply (orders for cars of less than 50,000 lb. will not be accepted by the carrier), through commodity rates from Tulsa, Okla., to Missouri points as shown in E. B. Boyd's Tariff 132G, on the same scale as published today from Ada, Okla.; namely, to points in Scale II territory, Scale II territory rates, and to points in Scale III territory, Scale III territory rates as described in I. C. C. Docket 8182. Shipper contemplates the erection of a cement plant at Tulsa, Okla. At the present time there are no through commodity rates, with the exception of the rate published from Tulsa, Okla., to Missouri points taking St. Louis basis; this rate is 30½c per 100 lb., authority S. W. L. Tariff 15N. Shipper desires to establish same scale of rates from Tulsa, Okla., as in effect today from Ada, Okla., to this same territory under I. C. C. Docket 8192.

21844. **Cement,** from St. Louis, Mo., and East St. Louis, Ill., on traffic originating points east of the Illinois-Indiana state line, to Ada, Okla., and Okay Junction, Ark. To establish a rate of 22½c per 100 lb. to Ada, Okla., and 21½c to Okay Junction, Ark., on cement, hydraulic, portland or natural, in straight or mixed carloads, minimum weight 50,000 lb. (except that where maximum capacity of the car used is less the actual weight but not less than 40,000 lb. will apply). Orders for cars of less than 50,000 lb. will not be accepted by the carriers from St. Louis, Mo., and East St. Louis, Ill., on traffic originating at points east of the Illinois-Indiana state line. Shippers request that they be placed on a parity with Fort Scott and Fredonia, Kan.

21856. **Cement,** from Tulsa, Okla., to Missouri points. To establish Scale III territory rates on cement, hydraulic, natural or portland, in straight or mixed carloads, minimum weight 50,000 lb., except that when marked capacity of car is less, the actual weight, but not less than 40,000 lb., will apply (orders for cars of less than 50,000 lb. will not be accepted by carriers), from Tulsa, Okla., to stations in Missouri (in the so-called "No Scale Territory"), on all lines south and east of St. L.-S. F. Ry. from St. Louis, Mo., to Springfield, Mo.

Shipper contemplates the erection of a cement plant at Tulsa, Okla. At the present time the only commodity rates from Tulsa, Okla., to Southeastern Missouri points are St. Louis and Memphis, Tenn., territory rates which make the rates the same to all points in these respective territories. It is desired to establish Scale III territory rates to this so-called "No Scale Territory."

21864. **Sacks, empty,** returned, from Illinois and Indiana to Ste. Genevieve and Mosher, Mo. To correct Item 30, page 15, S. W. L. Tariff 68M, I. C. C. 2248, by adding burlap bags that have been used in movement of pulverized limestone from Mosher and Ste. Genevieve, Mo. Less-carload one-half of fourth class. There are regular movements of pulverized limestone, carloads, from Mosher, Mo., to Chicago, Ill., and points taking Chicago rates in burlap bags. These bags are second hand and of a poorer quality than cement bags, and at the present time nothing better than fourth class rates. Cement bags for Marquette, Mo., move

right through Ste. Genevieve, Mo., at lower basis than the cheaper burlap bags.

21860. **Lime**, from Sherwood, Tenn., to Homer, La. To establish a rate of 27c per 100 lb. on lime (calcium), viz.: Common lime, hydrated, quick or slaked, straight or mixed carloads, minimum weight 30,000 lb., from Sherwood, Tenn., to Homer, La. Interested shippers have called attention to the fact that today nothing better than the lowest combination of rates made over Gibbsland, La., is applicable in connection with shipments of lime from Sherwood, Tenn., to Homer, La. The present rate from Sherwood, Tenn., to Monroe, Gibbsland, Rayville and Rustin, etc., is $4.70 per net ton or 23½c per 100 lb., and shippers have asked for the establishment of that rate to Homer, La. The present rate from Sherwood, Tenn., to Fordyce, Camden, Ark., etc., is $5.40 per net ton or 27c per 100 lb., per Item 3260 of S. W. L. Tariff No. 45-R and accordingly it is proposed to establish that rate at Homer, La., so as to prevent undue reductions at necessary intermediate points so as to clear the fourth section.

21871. **Sand**, from Gray and Shirk, Okla., to Columbus, Kan. To establish a rate of 6½c per 100 lb. on sand, carloads (See Note 1), except when car is loaded to full visible or space-carrying capacity, actual weight will govern, from Gray and Shirk, Okla., to Columbus, Kan.

It is stated that the proposed rate is the same as applicable from Price, Okla., which is less than one mile from Gray, Okla., and only 3½ miles from Shirk, Okla. Moreover, under the application of the 9702 scale on sand and gravel the proposed rates would apply to Columbus, Kan.

TEXAS-LOUISIANA TARIFF BUREAU DOCKET

S-7966-TX. **Sand and gravel**, carloads, from Hobbs Gravel Pit, Tex., to Temple, Tex.: Proposition from shippers to establish rate of $10 per car not loaded in excess of marked capacity, the charges per ton for excess loading shall be in proportion to the charges per ton under the per car charge as prescribed above. Rate is not to apply as basing rate or in dividing through rate. Switching charges of other lines to locations on lines other than M.-K.-T. of T. in Temple, Tex., will be in addition to the rate. Rate is proposed in order to recover traffic that is now moving by truck.

CENTRAL FREIGHT ASSOCIATION DOCKET

26945. To establish on **sand and gravel**, carloads (See Note 3), from Milwaukee, Wis., to Dayton, O., rate of $2.90, to *New Salisbury, Ind., $2.65 and to Paris, Ill., $2.30 per net ton. Present—Class basis.

*Railroad name is Corydon Junction, Ind.

26952. To establish on **sand and gravel**, carloads (See Note 3), from Vincennes, Ind., to Mt. Carmel, Ill., rate of 80c per ton of 2000 lb. Present—No through rates are in effect. Combination rates apply.

26953. To establish on **stone, crushed; stone screenings, and agricultural limestone** (not ground or pulverized); in bulk, carloads (See Note 3), from Milltown, Ind., to Seymour, Ind., rate of 105c per net ton. Present—114c per net ton.

26954. To cancel present commodity rates on **soapstone or talc**, ground, crude, in bags, carloads, minimum weight 40,000 lb., from Joliet, Ill., to Akron and Cleveland, O., Detroit, Mich., and South Bend, Ind., and restore classification basis in lieu thereof.

26956. To establish on **cement, common, hydraulic, natural or portland**, in carloads, minimum weight 50,000 lb., marked capacity of car to govern, if less, from Coldwater and Quincy, Mich., to points in Wisconsin, rates as shown in Exhibit B attached. Present—As shown in Exhibit B attached.

EXHIBIT "B"

To Wisconsin points	Pres. (6th Prop. class) rate	To Wisconsin points	Pres. (6th Prop. class) rate
From Coldwater, Mich.			
C. M. St. P. & P. R. R.			
Somers	21½ 13	Waukesha	21½ 14
Sturtevant	21½ 13	Granville	21½ 14
Burlington	21½ 13½	Templeton	21½ 14½
M. St. P. & S. S. M. R. R.			
Wheatland	21½ 13	Duplainville	21½ 14
Burlington	21½ 13½	Templeton	21½ 14½
Waukesha	21½ 14	Rugby Jct.	21½ 14½
From Quincy, Mich.			
C. M. St. P. & P. R. R.			
Somers	21½ 13	Waukesha	21½ 14
Sturtevant	21½ 13½	Granville	21½ 14
Burlington	21½ 13½	Templeton	21½ 14½
M. St. P. & S. S. M. R. R.			
Wheatland	21½ 13½	Duplainville	21½ 14½
Burlington	21½ 13½	Templeton	21½ 14½
Waukesha	21½ 14	Rugby Jct.	21½ 14½

26965. To establish on **common sand and gravel**, carloads (See Note 3), from Leeland, Ind., to St. Joe, Ind., rate of 75c per ton of 2000 lb. (one-line haul of 49 miles). Present rate, 80c per ton of 2000 lb.

26972. To eliminate the Frankfort & Cincinnati R. R. Co. as a participating carrier in the following P. & L. E. R. R. issue: Tariff B No. 2445, applying on **agricultural limestone**, carloads, from stations on the Pittsburgh & Lake Erie R. R. to destinations in Illinois, Indiana, Iowa, Kentucky, Michigan, Missouri, New York, Ohio, Pennsylvania, West Virginia and Wisconsin.

26973. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads (See Note 3), from Wolcottville, Ind., to Ohio City, O., rate of $1 per net ton. Present rate, $2.80 per ton (sixth class).

26974. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and** gravel, carloads (See Note 3), from Wolcottville, Ind., to Brimfield, Ind., rate of 70c per net ton. Route—P. R. R., Kendallville, N. Y. C. R. R. Present rate, 80c.

26976. To establish on **limestone, agricultural** (not ground or pulverized), in bulk, in open-top cars; **stone, crushed**, in bulk, in open-top cars, and **stone screenings**, in bulk, in open-top cars, in straight or mixed carloads (See Note 3), from Woodville, Gibsonburg and Maple Grove, O., to points in Michigan, rates as shown below. Present and proposed rates:

From Woodville, O.

To	Prop.	Pres.	To	Prop.	Pres.
Blissfield	82	92	Deerfield	92	....
Riga	82	92	Petersburg	92	....
Ottawa Lake	82	92	Ida	87	....
Wellsville	87	....	Strasburg	87	....
Sissons	92	....			

From Gibsonburg, O.

To	Prop.	Pres.	To	Prop.	Pres.
Blissfield	87	92	Deerfield	92	....
Riga	87	92	Petersburg	97	....
Ottawa Lake	82	92	Ida	92	....
Wellsville	92	....	Strasburg	92	....
Sissons	92	....			

From Maple Grove, O.

To	Prop.	Pres.	To	Prop.	Pres.
Blissfield	92	97	Deerfield	102	....
Riga	92	97	Petersburg	102	....
Ottawa Lake	87	97	Ida	97	....
Wellsville	97	....	Strasburg	97	....
Sissons	97	....			

26980. To establish on **mica**, scrap, and mica ore, waste, crude, straight or mixed carloads, minimum weight 50,000 lb., from Godfrey, Ont., and Bancroft, Ont., to Somerset, Penn., rate of 33c. Route—Via Black Rock, N. Y.-B. R. & P. Ry., Willow Grove Jct. (Pittsburgh, Penn.), B. & O. Ry. Divisions—Agreed per cents. Present rates—From Godfrey, 44c; from Bancroft, 50½c.

26989. To establish on **crushed stone** and **crushed stone screenings, etc.**, carloads (See Note 3), from Bluffton, Ind., to points in Michigan. (Present rates, sixth class.)

To	Prop.	To	Prop.
Hillsdale	110	Adrian	115
Albion	115	Coldwater	115
Jackson	115		

27002. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica), carloads (See Note 3), from Toledo, O., to Detroit, Mich., rate of $1.15 per ton, applicable only on shipments in box cars. Present rate, $1 per net ton.

26830. Correction notice. Please correct Docket Advice No. 26830, Docket Bulletin 1886, dated November 19, 1930, proposal to establish on **fluxing stone**, carloads, from the Bedford-Bloomington, Ind., district to Portsmouth, O., rate of $1.76 per gross ton, by eliminating route and distance from Bedford, Ind., to Portsmouth, O., via C. I. & L. Ry., Mitchell, Ind., B. & O. R. R., Chillicothe, O., and N. & W. Ry., and substitute in lieu thereof a distance of 243.5 miles via C. I. & L. Ry., Mitchell, Ind., B. & O. R. R., Cincinnati, O., N. & W. Ry.

27035. To establish on **granulated furnace slag**, in bulk, in open-top cars (See Note 3), from Rankin and Bessemer, Penn., to Columbus, O., rate of $1.50 per ton of 2000 lb. Present rate, sixth class rate of 20½c.

27038. To establish on **lime**, other than agricultural and/or fluxing lime, minimum weight per Official Classification, from points in Indiana to Kokomo, Ind., rates as shown below. Proposed rates:

From	Rate
Becks, Ind.	13
Mitchell, Ind.	13
Murdock, Ind.	12½
Salem, Ind.	13½

Route—Via C. I. & L. Ry., Lafayette or Linden, Ind., N. Y. C. & St. L. R. R. Present rate, 14c.

27040. To establish on **limestone, ground or pulverized, and limestone dust**, carloads, minimum weight 50,000 lb., from Greencastle, Ind., to Louisville, Ky., rate of $1.90 per net ton. Present rate, 18½c (sixth class).

27049. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads (See Note 3), from Hibbard, Ind., to Gary, Ind., rate of 90c per net ton. Route—P. R. R., Liverpool, Ind., M. C. R. R. Present rate, $2.90 per net ton.

27050. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads (See Note 3), from Lake Ciecott and Kenneth, Ind., to Briant, Ind., rate of $1.05 per net ton. Present rate, classification basis.

27051. To establish on **crushed stone and crushed stone screenings**, carloads (See Note 3), from Huntington, Ind., to points in Indiana.

To	Pres.	Prop.	To	Pres.	Prop.
Athens	75	70	Newton	70	60
Akron	75	70	Bolivar	70	60
Disko	75	65	Servia	70	60
Laketon	70	60			

27052. To establish on **dolomite, burnt or roasted**, carloads (See Note 3), from Narlo, O., to Kokomo, Ind., rate of $1.96 per net ton. Present rate, $2.30 per net ton.

27055. To establish on **dolomite, roasted or burnt**, carloads (See Note 3), from Kenova, W. Va., to Detroit, Mich., rate of $2.66 per ton of 2000 lb. Routes—Via usual available routes. Present rate, $2.80 per ton of 2000 lb.

27058. To establish on **sand, blast, engine, foundry, glass or silica**, carloads (See Note 3), from stations on E. & O. V. Ry., to Harvard, Ill., rate of 265c per ton of 2000 lb. Present rate, 317c per ton of 2000 lb.

27065. To change commodity description in Item 2685 of C. F. A. Lines' Tariff 130-T, naming rate of 83.33% of sixth class on **stone, crushed**, in bags, minimum weight 50,000 lb., between points in Central Freight Association territory as described in above-mentioned tariff, also from points in said territory to points east of the western termini of Eastern Trunk Lines, also to Canada, to read as follows: "Stone, crushed, in bags or in bulk in box cars, minimum weight 50,000 lb."

27068. To establish on **sand and gravel**, carloads (See Note 3), from Connersville, Ind., to Hagerstown, Ind., rate of 60c per net ton. Present rate, 70c per net ton.

27069. To establish on **refuse foundry sand**, carloads, minimum weight 50,000 lb., from Peoria, Ill., and Muncie, Ind., to Indianapolis, Ind., rates as shown below (in cents per net ton):

From	Pres.	Prop.
Peoria, Ill.	21	162
Muncie, Ind.	13	140

TRUNK LINE ASSOCIATION DOCKET

25268. **Stone, natural** (other than bituminous asphalt rock), **crushed**, carloads (See Note 2), from South Bethlehem and Feura Bush, N. Y., to Schodack Landing, Newton Hook, Stockport and Hudson, N. Y., 90c per net ton. Present rate, $1.10 to Schodack Landing and Newton Hook, N. Y., and $1.20 to Stockport and Hudson, N. Y. Reason—Rates comparable with others involving like distances.

M-1579. To increase rate on **crushed stone, coated with oil tar or asphaltum**, carloads (See Note 2), from Akron and LeRoy, N. Y., groups as follows:

To points in New York and Pennsylvania—	Prop. rates
Angola, N. Y.	$0.96
Athol Springs, N. Y.	0.96
Brocton, N. Y.	1.19
Cassadaga, N. Y.	1.19
Derby, N. Y.	0.96
Dunkirk, N. Y.	1.19
Falconer, N. Y.	1.30
Farnham, N. Y.	1.07
Fentonville, N. Y.	1.42
Forsyth, N. Y.	1.30
Fredonia, N. Y.	1.19
Frewsburg, N. Y.	1.42
Gerry, N. Y.	1.30
Irving, N. Y.	1.07
Jamestown, N. Y.	1.42
Laona, N. Y.	1.19
Lily Dale, N. Y.	1.19
Moons, N. Y.	1.19
Nortons, N. Y.	1.19
Portland, N. Y.	1.19
Ripley, N. Y.	1.30
Silver Creek, N. Y.	1.07
State Line, N. Y.-Penn.	1.30
Titusville, Penn.	1.76
Sinclairville, N. Y.	1.30
Van Buren, N. Y.	1.19
Waites Crossing, N. Y.	1.07
Westfield, N. Y.	1.19

Same basis of rates as applicable from Buffalo, N. Y.

M-1580. **Cement**, carloads, from Binnewater and Brixment, N. Y., to stations on Washington and Old Dominion Ry. Rates ranging from 17½c to 28c per 100 lb. Reason—Rates comparable with rates from other cement producing points.

25293. **Crushed stone**, carloads (See Note 2), from Strasburg Jct., Va., to W. & O. D. Ry. stations, Alexandria Jct., Herndon, Leesburg, Bluemont, Alexandria, Va., and various. Rates ranging from $1 to $1.60 per net ton. Reason—Proposed

rates are comparable with rates from Riverton, Va., to same points.

25271. **Cement, common, hydraulic, natural or portland,** in straight or mixed carloads, minimum weight 50,000 lb., from Buffalo, N. Y., Bessemer, Kenney Yard, Crescentdale, Wampum, New Castle, Walford, West Winfield and Neville Island, Penn., to points on the Elk River Branch of Western Maryland railway. Rates ranging from 15c to 17½c per 100 lb. Reason—to provide rates on comparable basis of rates from other cement producing points.

25307. **Glass sand,** carloads (See Note 2), from Mapleton District, Penn., to Olean, N. Y., $2.25 per net ton. (Present rate, $2.75 per net ton.) Reason—Proposed rate is comparable with rates to Port Allegheny, Brockway and Sheffield, Penn.

25308. **Sand other than blast, engine, foundry, molding, glass, silica, quartz or silex, and/or gravel,** carloads, from Morrisville, Penn., to Rambo, Penn., $32 per car when in lots of 30 cars or more. Reason—to meet motor truck and barge competition.

25314. To establish rates on **cement,** carloads, from all producing points in Trunk Line territory to Chaffee Branch of the Western Md. Ry. on basis of flat 114% of 12710 scale.

25318 (cancels 25249). **Spent or refuse grinding sand,** in box cars, carloads (See Note 2), from Butler, Penn., to Versailles, Penn., $1.05 per net ton. Reason: Proposed rate is fairly comparable with rates from Butler, Penn., to other points in the Pittsburgh district.

25327. (A) **Lime, viz., common, hydrated, quick or slaked,** except agricultural and fluxing lime having no commercial value for chemical or building purposes, carloads, minimum weight 30,000 lb.; (B) **Lime, viz., agricultural and fluxing,** having no commercial value for chemical or building purposes, carloads, minimum weight 30,000 lb., from Bellefonte, Duncansville, Frankstown, Pleasant Gap, Goodman, Stover, Tyrone Forge and Union Furnace, Penn., to Lick Run Mine to West Alexander, Penn., incl., (A) 15c and (B) 12c per 100 lb. Reason: Proposed rates are comparable with rates to 60% points.

25343. **Crushed stone,** carloads (See Note 2), from Montclair Heights and Upper Montclair, N. J., to Jersey City, Croxton and West End, N. J., 60c per net ton. (Present rate, 92c per net ton.) Reason—To meet motor truck competition.

25359. **Slag, crude or crushed,** in bulk, carloads (See Note 2), from Baltimore, Md., to Rosslyn, Va., 90c per net ton. (Present rate, $1.05 per net ton.) Reason: Proposed rate is comparable with rate to Washington, D. C.

25361. **Cement,** carloads, to destinations on Grand Trunk Railway, East Alburgh and Alburgh Springs, Vt., from Binnewater, N. Y., 16c, and from Alsen, Hudson, Glens Falls and Howe's Cave, N. Y., 15½c per 100 lb. Reason: Proposed rate is comparable with rates on like commodities for like distances, services and conditions.

25370. **Stone, chips and granules,** carloads, minimum weight 40,000 lb., from Texas and Cockeysville, Md., to Richmond, Va., $2.25 per net ton. Present rate, $3.20 per net ton. Reason: Proposed rate is comparable with rates to Washington, D. C., Hazleton, Penn., and Bridgeton, N. J.

25373. **Stone, natural** (other than bituminous asphalt rock), **crushed and stone, crushed, coated with oil, tar or asphaltum,** carloads (See Note 2), from South Bethlehem, N. Y., to Kingston, N. Y., $1 per net ton. Present rate, $1.10 per net ton. Reason: Proposed rate is comparable with rate from South Amsterdam, N. Y., to Herkimer, North Ilion and Whitesboro, N. Y.

25375. **Fire and ganister stone,** carloads (See Note 2), from Three Springs, Penn., to Philo, O., $2.60 per net ton. Present rate—Combination. Reason—Proposed rate is fairly comparable with rate from Mt. Union, Penn.

25380. **Stone, natural** (other than bituminous asphalt rock), **crushed,** carloads (See Note 2), from New Hamburg, N. Y., to Chatham Centre, Niverville, Van Hoesen, Brookview, N. Y., $1.35 per net ton. Present rate, $1.60 per net ton. Reason—Proposed rate compares favorably with rates to Chatham, Ghent and Pulver's, N. Y.

25259, Sup. 1 (A) **Sand, building,** carloads; (B) **Sand, glass, engine, molding and ground flint,** in straight or mixed carloads (See Note 2), from Berkeley Springs-Hancock District to Peterboro, Belleville, Kingston, Port Hope, Ont. (A) $5.35, and (B) $5.60; to Oshawa, Ont., (A) $4.85, and (B) $5.10 per net ton; also establish rates on **glass sand,** from Triplett, Va., to Peterboro, Belleville, Kingston and Port Hope, Ont., $5.80; and to Oshawa, Ont., $5.30 per net ton.

25395. **Sand and gravel,** carloads (See Note 2), from Petersburg, Puddledock and Hopewell, Va., to Winchester, Va., $2.20 per net ton. (Present rate, $2.80 per net ton.) Reason—Proposed rate is fairly comparable with rate to Harrisonburg, Va.

25396. **Sand, viz., blast, common, engine** (will not apply to points in Canada), **glass, molding, quartz, silica, silex, flint, ground, and rock, ganister,** minimum weight as per Item 6385-D, Sup. No. 29 of Agent Curlett's I. C. C. A-265, from Berkeley Springs, Great Cacapon, Hancock, W. Va., and Cumberland, Md., to East Sparta, O., 14c per 100 lb. (Present rate, class rate.) Reason—Proposed rate is comparable with rate to New Philadelphia, Canton, O., etc.

25398. (A) **Building lime,** carloads, minimum weight 30,000 lb.; (B) **Agricultural and land lime,** carloads, minimum weight 30,000 lb. (C) **Chemical, gas and glass lime,** carloads, minimum weight 30,000 lb. (D) **Ground limestone,** carloads, minimum weight 50,000 lb. To Carolina, W. Va.

From—	—Proposed rates— (A)	(B)	(C)	(D)	Present rate
Bellefonte, Penn.	17	15	16½	13	25½
Pleasant Gap, Penn.	17	15	16½	13	25½

The above rates in cents per 100 lb. Reason—Proposed rates are fairly comparable with rate to Elkins, Parsons and Durbin, W. Va.

25402. **Cement,** carloads to Susquehanna and New York R. R. stations, Towanda to Ralston, Penn., from Alsen, N. Y., rates ranging from 15½c to 17c; from Binnewater, rates ranging from 15c to 17c; from Brixment, rates ranging from 13½c to 15c; from Buffalo, East Buffalo and Black Rock,, N. Y., rates ranging from 14½c to 15c, and from Hudson, N. Y., rates ranging from 15½c to 17c per 100 lb. Reason—Proposed rates are based on 114% of I. C. C. Docket 12710 scale.

M-1610. **Gravel,** carloads (See Note 2), from Montauk, N. Y., to Amagansett, East Hampton, 80c, and Wainscott, Bridgehampton, Water Mill and Southampton, N. Y., 90c per net ton. Reason—To meet motor truck competition.

25404. **Sand and gravel,** other than blast, engine, foundry, glass, molding or silica, carloads (See Note 2), from Maplewood, Penn., to Honesdale, Penn., 80c per net ton. Present rate, $1.05 per net ton. Reason—Proposed rate is comparable with rates to Avoca and Pittston, Penn.

25415. Make the following changes in B. & O. R. R. I. C. C. 21120 publishing rates on **building, engine, blast, glass and molding sand and ground flint,** from Berkeley Springs, Great Cacapon and Hancock, W. Va.; **ganister rock,** from Berkeley Springs and Hancock, W. Va., and **glass sand,** from Winchester, Va., to points on the Erie R. R.:

Cancel route via B. & O. R. R., New Castle, Penn., Erie R. R., in connection with rates on sand and ground flint, from Berkeley Springs, Great Cacapon and Hancock, W. Va., to Rochester, Depew, East Buffalo, Buffalo (Louisiana St.), Black Rock, Niagara Falls, Lockport and Salamanca, N. Y.

Cancel route via B. & O. R. R., New Castle, Penn., Erie R. R., in connection with rates on ganister rock, from Berkeley Springs, W. Va., to East Buffalo, Buffalo (Louisiana St.), Black Rock, Niagara Falls, Suspension Bridge and Salamanca, N. Y.

Cancel proportional rates on glass sand, from Winchester, Va., to Binghamton, East Buffalo, Buffalo (Louisiana St.), Black Rock and Salamanca, N. Y.

Establish route via B. & O. R. R., Willow Grove Jct., Penn., B. R. & P. Ry., Salamanca, N. Y., Erie R. R., to East Buffalo, Buffalo (Louisiana St.), and Black Rock, N. Y., in connection with present rates on sand and ground flint, from Berkeley Springs, Great Cacapon and Hancock, W. Va., and on ganister rock from Berkeley Springs and Hancock, W. Va.

No change in rates involved in connection with these revisions in routes.

It is further proposed to establish rate of $2.95 per 2000 lb. on **glass sand** (See Note 3), from Triplett, Va., to Binghamton, East Buffalo, Buffalo (Louisiana St.), and Black Rock, N. Y., via W. & W. R. R., Winchester, Va., B. & O. R. R., Willow Grove Jct., Penn., B. R. & P. Ry., Salamanca, N. Y., Erie R. R. No through rates are published at the present time.

Reason—Cancellation of the New Castle, Penn., route is to clear up fourth section departures. For the purpose of uniformity it is proposed to restrict rate on ganister rock, etc., to the Willow Grove-Salamanca route.

Cancellation of proportional rates on glass sand from Winchester, Va., is in order by reason of the fact that there are no points on the W. & W. R. R. now producing glass sand other than Triplett, Va., and through rates are in effect from Triplett, or are being established as the necessity arises for rates from that point. Proportional rates are therefore obsolete.

Rate on glass sand from Triplett, Va., to East Buffalo, etc., is comparable with rates to Niagara Falls, Lockport, N. Y., etc.

25423. **Crushed stone,** carloads (See Note 2), from Millville, W. Va., to Great Cacapon, 90c, and Paw Paw, W. Va., $1 per net ton. Rates to expire April 1, 1931. Reason—Proposed rates are comparable with rates from Martinsburg, W. Va., to Paw Paw, W. Va.

25436. **Sand and gravel,** carloads (See Note 2), from Raritan River R. R. stations to L. V. R. R. stations, Furnace, Slatedale, Balliet, Mauch Chunk, Penn Haven Jct., Park Place, Sugar Notch, Penn., and various. Rates ranging from $1.60 to $2.30 when loaded in open-top equipment; rates ranging from $1.80 to $2.52 per net ton when loaded in box cars or other closed equipment. Reason—Proposed rates are comparable with rates on like commodities from and to points in the same general territory.

25437. **Crushed stone,** carloads (See Note 2), from Grove and Frederick, Md., to points in West Virginia (proposed rates per 2000 lb.):

To	Prop.	To	Prop.
Johnson	145	Cunningham	155
Pancacke	145	Moorefield	155
Globe	145	Durgon	165
McNeil	145	Petersburg	165

Reason—Proposed rates are fairly comparable with rates from Martinsburg, W. Va., to same points.

25438. **Slag,** carloads (See Note 2), from Catasauqua and Hokendauqua, Penn., to Reading company stations, Trenton Jct., Glen Moore, Manville, South Bound Brook, Durham, Port Reading, N. J., and various. Rates ranging from $1.20 to $1.40 per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions within this same general territory.

25439. (A) From Philadelphia, Penn., (B) from Camden, N. J., (C) from Paulsboro, N. J.

Proposed rates on phosphate rock, crude lump or ground, carloads, minimum weight 40,000 lb.:

To	(A)	(B)	(C)
Robbinsville, N. J.	10	10	*205
Hightstown, N. J.	11	11	*225
Cranbury, N. J.	11	11	*225
Englishtown, N. J.	....	12	*245
Freehold, N. J.	....	12	*245

Proposed rates on superphosphate (acidulated), phosphate rock in bulk, carloads, minimum weight 40,000 lb.:

To	(A)	(B)	(C)
Robbinsville, N. J.	10	10	*205
Hightstown, N. J.	11	11	*225
Cranbury, N. J.	11	11	*225
Englishtown, N. J.	....	12	*245
Freehold, N. J.	....	12	*245

Proposed rates on muriate of potash, carloads, minimum weight 40,000 lb.:

To	(A)	(B)	(C)
Robbinsville, N. J.	10	10	*205
Hightstown, N. J.	11	11	*225
Cranbury, N. J.	11	11	*225
Englishtown, N. J.	12	12	*245
Freehold, N. J.	12	12	*245

*In cents per 2000 lb., otherwise in cents per 100 lb.

Reason—Proposed rates compare favorably with rates from Philadelphia to Swedesboro, Woodstown and Bridgeton, N. J. Proposed rates on muriate of potash are comparable with rates on other fertilizer materials from Philadelphia, Penn., to Jamesburg, Princeton Jct., N. J., etc.

25443. **Hollow building blocks and tile,** made of blast furnace slag and portland cement, carloads, minimum weight 60,000 lb., from Bound Brook, N. J., to Minneapolis, Minn., $9 per net ton. (Present rate, 65c per 100 lb., sixth class.) Reason—Proposed rate is same as now in effect on brick from the Perth Amboy district.

25445. Establish switching charge of $10 per car on **crushed stone,** from siding of Blair Limestone Co., at Millville, W. Va., to team track of the B. & O. R. R. at Millville, W. Va. Reason—Proposed rate compares favorably with rate at other points on the B. & O. R. R.:

25446. To add **lime, building,** to list of commodities in Item 105 on page 6 of L. I. R. R. Tariff I. C. C. 873, at carload minimum weight of 40,000 lb., taking rates as shown in Class "F" applicable between points on the Long Island R. R. Through error in the reissue of the tariff, building lime was omitted from this list.

25449. **Crushed stone,** carloads (See Note 2), from Morrisville, Penn., to Atsion, N. J., $1.25 per net ton. (Present rate, $1.40 per net ton.) Reason—Proposed rate is comparable with rate on like commodities for like distances, services and conditions.

25450. **Agricultural lime,** carloads, minimum weight 30,000 lb., from Jersey Shore, Penn., to Pusher Siding and Newfield, Penn., 14½c per 100 lb. (Present rate, 22½c per 100 lb., sixth class.) Reason—Proposed rate is comparable with rate from Bellefonte, Penn., to same points.

25103, Sup. 1. **Limestone, unburnt, ground or pulverized,** carloads, minimum weight 80,000 lb., from Western Maryland Ry. lime producing points to Deal, Penn., $1.50; Meyersdale, Garrett, Rockwood, Casselman, Penn., $1.60; Confluence, Penn., $1.70, and Connellsville, Penn., $1.80 per net ton.

25463. To cancel the Frankford & Cincinnati R. R. Co. as a participating carrier in the following P. & L. E. R. R. issue: Tariff B No. 2445, I. C. C. 2536, applying on **agricultural limestone,** carloads, from stations on the Pittsburgh & Lake Erie R. R. to destination in Illinois, Indiana, Iowa, Kentucky, Michigan, Missouri, New York, Ohio, Pennsylvania, West Virginia and Wisconsin.

M-1614. To establish rates on **soapstone refuse, crushed or ground,** carloads, minimum weight 40,000 lb., from Rockfish, Va., when from Nelson and Albemarle Ry. stations to C. F. A. territory,

same rates as now in effect from Esmont, Va., when from Nelson and Albemarle Ry. stations to same destinations; also to establish from Clifton, Va., to C. F. A. territory rate of 27c per 2000 lb. higher than the proposed rates from Rockfish, Va., thereby placing Clifton, Va., on comparable basis with Schuyler, Va.

25464. **Crude fluxing limestone,** carloads (See Note 2), from Annville, Myerstown, Palmyra, and Swatara, Penn., to Palmerton, Penn., $1.30 per gross ton. (Present rate, $1.40 per gross ton.) Reason—Proposed rate is comparable with rates on like commodities for like distances, services and conditions in this same general territory.

M-1616. On run of **quarry stone, rip rap and quarry refuse,** carloads, minimum weight 30 tons per car in lots of 25 cars or more, to Oswego, N. Y., from Jamesville, N. Y., Munns, Watertown, Chaumont, N. Y., 50c, and from Artisco, N. Y., 45c (proportional) per net ton.

M-1618. **Gravel,** carloads (See Note 2), from Montauk, N. Y., to Amagansett, East Hampton, N. Y., 80c; Wainscott, Bridgehampton, Water Mill, Southampton, N. Y., 90c per net ton. Reason —To meet motor truck competition.

ILLINOIS FREIGHT ASSOCIATION DOCKET

5949. **Stone, crushed,** carloads (See Note 3), but not less than 40,000 lb., from White Bear, Mo., rates, 100 lb., per net ton:

To (representative points)	Pres.	Prop.
Dundee, Ill.	16½	$2.03
Freeport, Ill.	16	2.03
Milwaukee, Wis.	17½	2.14
Bloomington, Ill.	13	1.63
Decatur, Ill.	12½	1.26
Watertown, Wis.	17½	2.30

5933. **Lime rock or limestone, broken, crushed or ground,** carloads, from Mosher and Ste. Genevieve, Mo., to Peoria, Ill. Rates per net ton. Present, $2.10; proposed, $1.75.

5938. **Limestone quarry refuse,** consisting of dirt and stone, (See Note 1), from East St. Louis, Ill., to Spanish Lake, Mo. Present, 8; proposed, 7.

Pennsylvania Producer Files Complaint on Stone Rates

CHARGES of unjust and unreasonable rates on crushed stone were made recently by the Tioga Washed Sand and Gravel Co. of Tioga, Penn., in a complaint filed with the Public Service Commission against the New York Central and the Erie railroads.

Mica Rates Readjusted

A READJUSTMENT of rates on mica from points of origin in North Carolina and Virginia to a limited number of destinations in official territory, to be made effective not later than February 2, has been ordered in No. 22192, J. B. Preston Co., Inc., et al. vs. C. C. & O. et al.; No. 22263, Richmond Mica Corp. vs. A. C. & Y. et al.; No. 22225, U. S. Mica Manufacturing Co. vs. C. C. & O. et al., and I. and S. No 3346, ground mica from Richmond, Va., to central territory. The commission, by division 5, has found unreasonable the rates on wet-ground mica, from Spruce Pine and Penland, N. C., to destinations in official territory to the extent they exceed or may exceed by more than 15 cents per 100 lb. the corresponding rates from Richmond, Va., to trunk line and New England territories and to central territory to the extent that they bear a higher percentage relation to the corresponding rates from Richmond than is borne by the first class rates from Spruce Pine to the corresponding first class rates from Richmond to the same destinations.

In the suspension proceeding the commission has found justified the proposed restriction in the application of commodity rates on ground mica, carloads, from Richmond to destinations in central territory. The order of suspension has been vacated and the proceedings discontinued.

A further finding is that the rates on scrap or waste crude mica, carloads, from Franklin, N. C., to Rutherford, N. J., and from Spruce Pine to Forest Park, Ill., and Rutherford are and for the future will be unreasonable to the extent that they exceed or may exceed 39, 32 and 30 cents, respectively.

These specific findings are exceptions to a general finding that the rates on wet-ground mica and mica schist, from Richmond to destinations in official territory, on wet-ground mica from Spruce Pine and Penland and on dry-ground mica from Franklin to destinations throughout the United States and Canada, and on scrap or crude mica, from Spruce Pine and Forest Park and Rutherford are not unreasonable or otherwise unlawful. Under that general finding No. 22263, Richmond Mica Corp. vs. A. C. & Y. et al., was dismissed. That complaint alleged that the rates on ground or pulverized mica, from Richmond to destinations in Maryland, Pennsylvania, New Jersey, New York, Massachusetts, Canada, Wisconsin, Michigan, Illinois and Ohio were unreasonable. Reasonable rates and reparation were requested, the reparation to be on shipments made since October 22, 1925. The nature of the other complaints are indicated, it is believed, by the findings of unreasonableness and that the allegations of undue prejudice and undue preference had not been sustained.

The carriers proposed the restriction in the application of commodity rates from Richmond because, as they said, they had published them to apply on wet-ground mica on the impression that thereby they would align the rates from that point with rates from other points when, as a matter of fact, failure to restrict put the adjustment out of line.

With a view to making a clear distinction between what was called, by those interested in the cases, crude biotite schist, on the one hand, and dry-ground mica schist and the schist reclaimed from clay and kaolin washings, the commission suggested a commodity description of mica schist reading "mica schist, dry-ground and/or screened, including unground mica screenings from clay and kaolin washings or residue, carload minimum 60,000 lb." It did not, however, include that description in its orders.

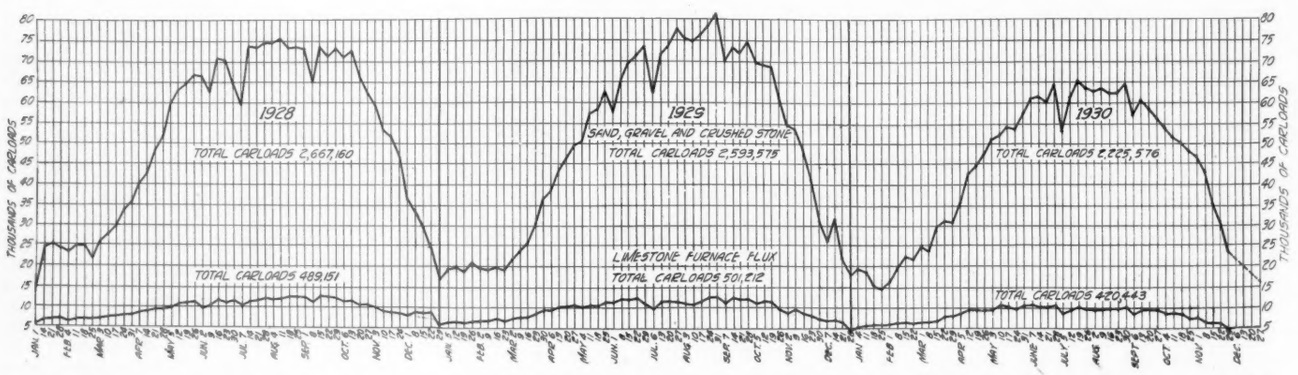
I. C. C. Decisions

22704. Crushed Marble. The Interstate Commerce Commission, by division 3, in No. 22704, M. R. Walker vs. C. C. C. & St. L. et al., has found unreasonable the charges on a shipment of crushed marble, in bags, from Tate, Ga., to Danville, Ill., because the Louisville & Nashville did not have a rule in its tariffs to take care of situations brought about by its failure to furnish a car of the size ordered by the shipper in the event a car of greater capacity was furnished. It found the failure of the Louisville & Nashville, in that respect, was unreasonable. Reparation was awarded on the basis of the smaller car ordered.

In this case the shipper asked for a car of 60,000 lb. capacity. The shipment weighed 60,500 lb. The Louisville & Nashville furnished a car with a marked capacity of 100,000 lb. Charges were collected at the applicable commodity rate of $2.25 a net ton, minimum weight 90% of the marked capacity of the car, to Louisville, Ky., plus the applicable sixth class rate of $4.10 a net ton, minimum 40,000 lb. beyond.

The Commission found unreasonable the failure of the Louisville & Nashville to provide a tariff rule to the effect that when a car of the capacity of dimensions ordered by a shipper, provided for in the tariff, could not be furnished within a reasonable time and for its own convenience a larger car was furnished, such larger car should be used upon the basis of the minimum weight applicable to the car ordered, but in no case upon the basis of less than the actual weight, provided that the shipment could have been loaded upon or in a car of the size ordered. There was also an allegation that the Louisville & Nashville had misrouted the car, but the Commission held that there was no misrouting.

23190. Sand. Northern Indiana Sand and Gravel Co. vs. Wabash et al. By division 3. The alleged failure of the defendants to comply with the order in Chicago Gravel Co. vs. A. T. & S. F., 118 I. C. C. 633, found not to present an issue for determination in this proceeding and therefore complaint has been dismissed. Defendants published a rate of 95 cents a net ton from Winona Lake, Ind., to Chicago, based on an order to remove undue prejudice. Complainant contended the rate should have been 75 cents. Commission said the question of whether its order had been complied with would be the subject of investigation.



Car loadings of sand, gravel and stone (above) compared for three consecutive years, with last five weeks of 1930 figures interpolated. Below, the same data on limestone flux for the steel industry

Berkshire Lime and Stone Co. Moves Offices to Hudson, New York

CLYDE H. DEWITT, who has been elected president and general manager of the Berkshire Lime Stone Corp., announced recently that the executive offices of the company which are now located at 165 Broadway, New York City, would be removed to Hudson, N. Y., from which he would direct the business of the corporation. The company has taken offices in the Hoffman Building at the corner of Seventh and Warren streets.

The Berkshire Lime Stone Corp. has its plant at Richmond, Mass., and manufactures mason's and finishing limes. It is the intention of the company to erect two kilns in addition to the four now at the plant. The company also intends to install a crushing plant for the production of crushed stone and agricultural limestone.

The plant of the company comprises 276 acres situated alongside of the Boston and Albany railroad tracks at Richmond. A bed of humus comprising 70 acres is a part of the property on which there are also deposits of aluminum clay.—*Hudson* (N. Y.) *Star.*

Minneapolis, Minn., to Have New Gravel Concern

INCORPORATION of a new $200,000 firm to be known as The Twin City Sand and Gravel Co. was announced recently in St. Paul (ROCK PRODUCTS, January 3, 1931).

The incorporators are Herman C. Wenzel, former St. Paul commissioner, who has been named president; Harry E. Speakes, vice-president; Carl E. Speakes, treasurer; P. G. Speakes, secretary, and William A. Bergstrom.

The company will build offices on a site yet to be chosen. Temporary headquarters are at 415 North Griggs street.

One hundred acres of gravel deposits have been acquired just west of the Minneapolis city limits between Superior boulevard and the Great Northern railway tracks. A contract has been let for a silo-type washing and screening plant, the first of its kind in this part of the country. It will be in operation about March 15.

The firm was organized as a wholesale sand and gravel company. Retail sales will be handled by the Speakes Co. in St. Paul and by the P. G. Speakes Co. in Minneapolis.—*St. Paul* (Minn.) *Dispatch.*

Dravos to Build Crushing Plant

THE Dravo Contracting Co., Neville Island, Pittsburgh, Penn., is planning establishment of new stone quarry at Ellwood City, Penn., where property has been secured, with installation of quarrying and crushing machinery, conveying, and other equipment, to cost over $50,000.

Atlantic Gypsum Products Company to Rebuild

THE ATLANTIC GYPSUM PRODUCTS CO. (Portsmouth, N. H.), officials have rushed to completion the plans for rebuilding that part of the plant destroyed by the recent fire, and restoring the operating units and experimental departments. Work has already commenced on clearing the debris and reconstruction will begin at once.

The reconstruction necessary at the present time will be limited to providing adequate floor space on the site of building No. 6, destroyed by fire, to house the wood fiber products department. Necessary repairs to adjacent buildings are also included in the program. The mechanical equipment for the wood fiber division will be restored completely and production facilities expanded to meet the expected demand for the new products developed by this department.

A total of approximately $100,000 has been budgeted to cover the reconstruction and equipment program. It is estimated that the new plant will be ready for operation by April 1, 1931.

Reconstruction will be done by the Atlantic Gypsum Products Co., which has engaged Barrows & Co. of Boston, to act in a supervisory capacity.—*Portsmouth* (N. H.) *Herald.*

Central Illinois Gravel Company Expands

CONFIDENT in the future of Ottawa, Ill., and its industrial territory the Sheridan Sand and Gravel Co. is spending $100,000 for modernization of its plant, sixteen miles north of here.

This new plant is being built to properly serve the present business and to take care of the increased business which is bound to follow in the general improvement of business conditions. This new plant costing approximately $100,000, will have a maximum capacity of 80 cars per day or approximately 400,000 tons per year.

The new plant site and new incoming track and storage yards are being staked out recently to be ready for the excavating machinery. The new plant is to be entirely completed and ready for operation on or before March 15, 1931.

The officers and directors of the Sheridan Sand and Gravel Co., who have brought about the consumation of this new project for the local community are as follows: Louis A. Wilson, president and general manager; Le Roy B. Light, vice-president, in charge of plant construction and operation; John A. Walters, secretary; R. G. Near, in charge of sales; J. G. Dingle, in charge of accounts and finances; and a unanimous group of preferred stockholders; practically all of whom are local people.—*Ottawa* (Ill.) *Times.*

Northwestern Ry. Reported Ready to Sell Stone Plant

AFFAIRS in connection with the Northwestern railway's stone crushing plant north of La Grande, Ia., are considerably up "in the air." Rumors have been flying around for several months that there might be "something doing" sooner or later and it begins to appear that it may be sooner.

At any rate, following out instructions of the high officials of the railroad company, all the property is being assembled and inventoried preparatory to advertising it for sale. Just how it is to be sold and other details in connection therewith are not clear.

Whether it means the plant will be operated this coming season or not remains to be seen. The company was at heavy expense the past summer in removing the dirt from above a section of stone sufficient to keep the big crusher busy for two years and it does not look reasonable that the quarry would be closed down for good. There is an unlimited quantity of stone ready for the big steam shovel by simply going down to a lower level, and that contingency has been gone into and has been pronounced practical by engineers.—*Le Grande* (Ia.) *Reporter.*

Slate Companies Merge

EFFECTIVE January 1, the selling interests of the Keenan Structural Slate Co. of Easton and Pen Argyl, Penn., and the Structural Slate Co. of Pen Argyl were consolidated. This brings together the two largest slate marketing organizations in Pennsylvania. The general offices will continue at Pen Argyl, operating as the Structural Slate Co.

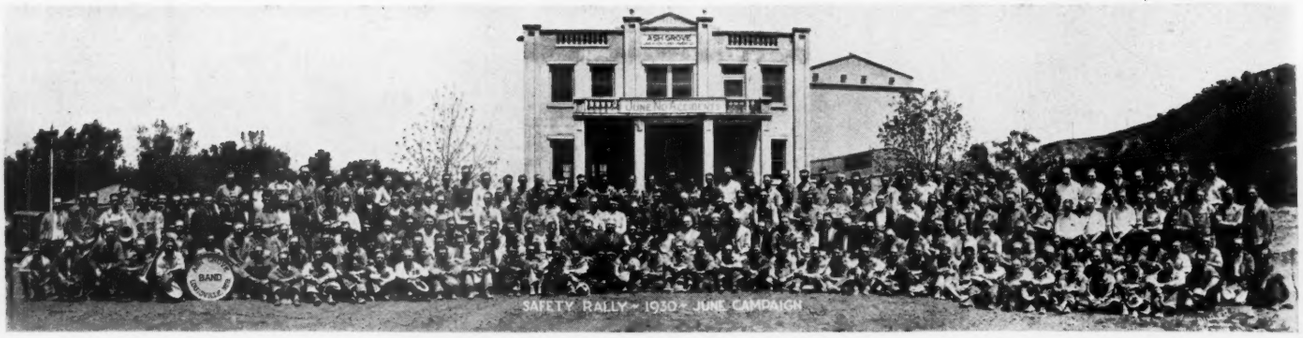
L. Renton Brown, Easton, will continue as president of the Keenan Structural Slate Co. and also will be associated with the selling companies as general sales manager.

The Structural Slate Co. maintains branch offices in 20 leading cities in the United States and Canada, and with the acquisition of the Keenan interests now markets the output of 22 quarries, in addition to handling a considerable business in the Vermont slates.—*Easton* (Penn.) *Express.*

River Sand Plant Burns

THE SAND PLANT belonging to D. H. Hardman Construction Co. at Scandia, Kan., was burned December 28, the fire occurring about midnight. The crew had been working at the plant and had left at 12 o'clock for their midnight meal. Upon returning they found the plant almost completely destroyed by fire.

The plant consisted of an 8-in. pump, a Diesel engine valued at about $7500 and lumber forming a working platform screening chute, etc. The pump and engine were supported in midstream by a raft made up of 100 oil drums.—*Alton* (Kan.) *Empire.*



Safety rallies are attended in full force at Ash Grove plant

Accident Prevention at Ash Grove Lime and Portland Cement Co.'s Louisville, Neb., Plant

By A. K. Frolich
Superintendent

THE PREVENTION of personal injury to our men has been one of the prime considerations since the beginning of our organization, and we stress the great importance of thinking and practicing safety in all our plant activities.

An intensive campaign was launched last January to beat "Old Man Accident" for the year 1930, and up to the present writing we have not had a single lost-time accident.

At the beginning of the year an accident prevention committee of three men was appointed to act as a general safety committee during the year. D. W. Webb, chief draftsman, was appointed chairman, with Construction Foreman Eugene Wheeler and Mill Foreman J. W. Kimbrell as assistants. All safety suggestions, accidents and near-accidents are investigated by this committee and discussed with the superintendent before final action is taken. We are just as interested in studying near-accidents as actual accidents, and whenever possible a sketch, showing such cases, is posted on the bulletin board.

Employes were assigned to four teams, each team having a color designation with button to wear for identification. Each team has its captain, with two lieutenants, who supervise their team-mates.

A large bulletin board, on which four clock hands were mounted, was erected in a conspicuous place. A clock hand was designated for each team, and the hand is moved daily to correspond with the advancement made in the race.

The main idea of the race is, of course, to keep up safety enthusiasm, so each day that a team has no accident its clock-hand is moved four points ahead. A team loses one point for each minor or major accident, which is reported within 30 minutes after its occurrence. Each accident not reported within this time limit causes a loss of four points, the idea of this method of scoring being to promote the securing of first-aid for every accident, no matter how seemingly unimportant, thus preventing infection occurring later.

A new race, with new scores, is started each month.

Safety bulletins and pictures of interest are placed on the bulletin board each day.

A rotating safety sub-committee of three is a regular feature of our safety work, each member serving for three months. The committee makes a monthly inspection and presents its recommendations in regard to safeguards, unsafe practices and general conditions. This report is thoroughly studied by the accident prevention committee and is discussed at the regular foremen's meeting.

Noon mass meetings are conducted monthly, employes being selected as speak-

The chairman of the Accident-Prevention Committee with the team captains. From left to right: P. L. Wright, machine shop foreman; C. F. "Blackie" Crawford, pack and sack house foreman; D. W. Webb, chairman; Claude D. Aney, yard foreman; Theo. "Fat" Wilcox, quarry foreman

Accident-Prevention and Safety Committee. Upper row, left to right: K. V. White, chief clerk; E. Wheeler, construction and repair foreman; E. C. Alfrey, storekeeper. Lower row, left to right: J. W. Kimbrell, kiln foreman; D. W. Webb, chief draftsman; B. H. Squires, carpenter

Score and Bulletin Boards—Left, race board; center, department progress. First column, foreman's name; second column, departments; third column shows lost-time accidents in 1929; the next columns represent the 12 months in 1930, a star being marked for each successful month. To the right is news board

ers to discuss safety work in their respective departments.

A June no-accident campaign was held. This was inaugurated with a safety rally and closed with a picnic for employes and their families. A very interesting program was presented, and later refreshments were served. This was attended by 750 people.

An Ash Grove band has been organized, and this band is a valuable aid in the entertainment feature of our safety meetings.

Our employes are being given first-aid training in line with the training given by the United States Bureau of Mines.

Alpha Plant Completes Four Years of Safety

ONE OF THE MOST interesting local safety celebrations of the year occurred at the Ironton, Ohio, plant of the Alpha Portland Cement Co. on Tuesday afternoon, December 9, in honor of the completion of four years' operation without a single lost-time, permanent disability or fatal accident. Since December 8, 1926, when an employe was injured in the burning department, the plant organization has not lost a day's pay or a month's bonus. In the plant shops, which is the banner department so far as length of safety record is concerned, there has been no accidental injury to an employe since August 23, 1921.

The affair on December 9 took the shape of a mass meeting under the auspices of the general safety committee of the plant. Superintendent Frank C. Brownstead and L. P. Patterson, chairman of the committee, were in charge. Among the speakers were A. S. Morgan, director of the Chesapeake and Ohio Railway Y.M.C.A., and Reverend Burnside of Russell, Ky. High praise was accorded to both management and men for working a total of 1460 days in entire safety, notwithstanding that the employed force frequently reaches as high as 400 men and the plant operates an extensive limestone mine.

The following are among a large number of telegrams received by Superintendent Brownstead:

"The board of directors, executives and members of the entire Alpha organization extend to you and our Ironton plant members our heartiest congratulations on completing four years of plant operation without a lost-time accident. This very remarkable record is one of which we, as well as you, are proud—F. G. McKelvey, vice-president, Alpha Portland Cement Co., Easton, Penn."

"The Chicago office joins me in congratulating your organization on your splendid record in elimination of accidents at the Ironton plant.—Henry McClarnan, general superintendent, Alpha Portland Cement Co., Chicago, Ill."

"Hearty congratulations to you and your entire organization on completing four years without a lost-time or more serious accident. You now hold the second longest safety record in the industry and we sincerely hope you may make it at least five years.—A. J. R., Curtis, assistant to general manager Portland Cement Association, Chicago, Ill."

"We are very sorry that we cannot be present at the celebration of your fourth year without a lost-time accident, as it is indeed a notable occasion. Please accept the hearty congratulations of the St. Louis organization with our sincere wishes for your future success in safety work.—F. R. Loveridge, superintendent, Alpha Portland Cement Co., St. Louis, Mo."

"Bellevue safety committee and superintendent wish to congratulate Mr. Brownstead and his organization on their splendid record made this day by completing a fourth year without a lost-time accident, also winning the Portland Cement Association trophy for the fourth time, which places the Ironton plant at the top of the Alpha no-accident list.—G. A. Lawniczak, superintendent, Alpha Portland Cement Co., Bellevue, Mich."

Frank C. Brownstead, superintendent of Ironton, Ohio, plant, Alpha Portland Cement Co.

Other Mills Also Celebrate

Since November 1 the following cement mills have celebrated safe records of one or two years as indicated:

November 1—Medusa Portland Cement Co., Bay Bridge, Ohio—1 year.

November 8—Alpha Portland Cement Co., Manheim, W. Va.—1 year.

November 13—Pacific Portland Cement Co., San Juan Bautista, Calif.—1 year.

November 14—Medusa Portland Cement Co., Dixon, Ill.—1 year.

November 17—Pacific Portland Cement Co., Redwood City, Calif.—2 years.

November 21—Diamond Portland Cement Co., Middle Branch, Ohio—1 year.

December 5—Canada Cement Co., Ltd., Exshaw, Alta.—1 year.

December 6—Pennsylvania-Dixie Cement Corp., Nazareth, Penn., No. 4—1 year.

December 8—Alpha Portland Cement Co., Ironton, Ohio—4 years.

December 10—San Antonio Portland Cement Co., San Antonio, Tex.—1 year.

December 11—Newaygo Portland Cement Co., Newaygo, Mich.—1 year.

December 12—Lehigh Portland Cement Co., New Castle, Penn.—1 year.

December 12—Trinity Portland Cement Co., Fort Worth, Tex.—1 year.

December 13—Lone Star Cement Co., Houston, Tex.—1 year.

December 14—Canada Cement Co., Ltd., Hull, Que.—1 year.

Indiana Sand and Gravel Men Meet to Discuss Roads and Lien Laws

THE ANNUAL MEETING of the Indiana Sand and Gravel Producers Association was held December 19, 1930, at the Claypool Hotel, Indianapolis, Ind., and was one of the best meetings ever held by the association, not only in point of interest but in the number of producers in attendance. There were 30 producers or their representatives present. This was said to be the largest number ever to have attended these annual Indiana state meetings.

The meeting was primarily intended for

W. H. Sanders, President

a discussion of the possibilities of using pea gravel and sand as an aggregate for the construction of low cost secondary road systems, and a discussion of the Indiana state lien laws. The following officers of the association were also elected: W. H. Sanders, of the Western Indiana Gravel Co., president, re-elected; Floyd Million, of the Million Sand and Gravel Co., vice-president; E. C. Theobald, of the Anderson-Theobald Co., director for the fifth district, and Ben Stone, of the Merom Gravel Co., director for the second district. S. C. Hadden will continue as secretary of the association.

After the appointment of the nominating committee and preliminary remarks, I. C. McDonald, representative of the Standard Oil Co. of Indiana, spoke on the use of pea gravels for aggregate in black-top road construction. He outlined the earlier history of black-top road construction in which crushed stone was the aggregate, and stated that the use of crushed stone was governed by circumstances and was not premeditated. He stated, however, that almost any contractor could use bitumen and crushed stone and make a reasonably good highway, but that when gravel was used the contractor had to "know his stuff" to get good results. Mr. McDonald stated that ½-in. gravel and smaller, even sands, could be used satisfactorily in a road of bitumen construction and that surfacing with gravel gave very satisfactory service. He stated that there was less likelihood of the gravel being crushed, with a corresponding loss in adhesion, than when other aggregates were used as a surfacing material.

Possible Market for Finer Sizes

Tom Kelley, a representative of the asphalt industry, gave an interesting talk on the possibilities of extending the marketing of the finer sizes of gravel and sand through bitumen road construction of a type that would be sufficiently low in first cost to make them applicable to feeder roads to the main arterial highways. He stated that there were 6,400,000 farms in the United States and that of this total 5,000,000 were not on an improved highway, and that it was these farms that secondary roads should endeavor to reach through the medium of all-season, low-cost secondary roads. He cited several bulletins that were published by the Asphalt Association on the use and construction of bitumen roads.

He called the producers' attention to the factors that make for stability of roads constructed from black-top material. He stated that stability was governed by the kind of asphalt used, amount of asphalt used, type of aggregate used, and advocated an aggregate mixture that would have a minimum of voids present. The chemical activity of the aggregate might also be a factor in a non-stable bitumen road, as certain limestones might have a higher activity than would gravels which are primarily silica or silicates. Mr. McDonald advocated low water absorption of the aggregates (2% or less), inasmuch as water is not desirable and sooner or later causes black-top roads to deteriorate.

He stressed the point of orderly grading of the aggregate so as to provide a maximum number of points of contact for construction of roads of the bitumen type.

He gave some data as to the cost of such secondary roads. His figures, based on an 80 c. freight rate and a cost of aggregate of $1 per ton, follow. He advocated using some ¾-in. gravel, but 60% to 65% of the aggregate would be pea gravel and sand. His costs were based on "open" and "closed" types of bitumen road, "open" types being deficient in sand, and the "closed" type being compact due to the sand filling. The following costs per mile are based on an 18-ft. roadway at the indicated thicknesses:

Type	1-in.	1½-in.	1¾-in.	2-in.
Open	$2666	$3900	$4670	$5330
Closed	3724	5850	6500	7480

Later discussion brought out that the figures were probably lower than past experiences of producers somewhat familiar with the asphalt industry indicated.

W. M. Holland, of the Contractors Association of Indiana, next took the floor and very ably presented the position of the contractors of Indiana on the lien law. His proposal was to repeal the lien law entirely except in its protection to labor. He asked

Floyd Million, Vice-President

the co-operation of the Indiana sand and gravel producers, contending that if the lien law were repealed it would help eliminate irresponsible, fly-by-night contractors, since the man's credit would be the governing factor and not the credit of the job.

While no formal action was taken on the proposal, it was apparent that the producers were almost to a man against it.

Jack Hays, of the Hays Co., road builders, was next introduced as an officer of the Pre-Coat Co. Mr. Hays described the process of emulsifying bitumens with water, explaining that ordinary asphalt either has to be cut (cut back) with lighter volatile oils or some other thinner used. In his process, water is used as the emulsifying agent and the aggregates dipped into a tank of this material by means of a suitable bucket elevator. The asphalt is kept at 150 to 200 deg. F. during the process.

Among the advantages claimed for this process are that the aggregates can be used wet and pit-run gravel can be used carrying up to 30% sand.

Court Alfs, of the Barrett Co., next presented data showing that 17% of the country's roads were improved during the past 25 years, and that with the 15,000 new cars per day that this country is absorbing, more highways must be built.

He displayed a series of advertising copy that his company is running in a national advertising campaign to awaken the taxpayers to the need of better and more highways, and which pointed out the advantages of Tarvia roadways.

President W. H. Sanders gave his report, followed by the report of Secretary S. C. Hadden. The secretary briefly outlined the political situation in Indiana, social legislation, gas tax matters and legislation relative to the proposal to make changes in allowable truck weight limits.

All Producers Hopeful for a Better Year

After the election of officers, the president called upon everyone present to make some remarks pertaining to the industry. Producers reported a short year in most cases, but expected 1931 to be an excellent one.

Wayne Nattkemper, superintendent of the Terre Haute Sand and Gravel Co., proposed that more superintendents be brought to future meetings, so that their experiences might be exchanged. Those in attendance were favorably impressed by his suggestion and at the meeting next year an endeavor will undoubtedly be made to have as many plant superintendents present as possible.

Registration

(PRODUCERS)

Anderson-Theobald Co., Vincennes, Ind.: Ed C. Theobald.
Baker Gravel Co., Noblesville, Ind.: Earl Baker.
Brown-Huffstetter Materials Co., Indianapolis: H. C. Huffstetter.
Connersville Gravel Co., Connersville, Ind.: Clyde Piper.
Consumers Co., Chicago, Ill.: James P. Coyle.
Delaware Sand and Gravel Co., Indianapolis: Donald Binford.
Indiana Gravel Co., Indianapolis, Ind.: Frank J. Billeter, Art Wilson, Art Lacy.
Kickapoo Sand and Gravel Co., Peru, Ind.: Jerome Chamberlin.
Maxwell Gravel Co., Indianapolis: Howard Maxwell, Bruce Maxwell.
Merom Gravel Co., Indianapolis: Ben Stone.
Million Sand and Gravel Co., Lake Ciecott, Ind.: Floyd and Frank Million.
Neal Sand Co., Mattoon, Ill.: Ben E. Neal, E. Guy Sutton.
South Bend Sand and Gravel Co., South Bend, Ind.: Herbert Hoffman.
Sturm and Dillard Co., Columbus, Ohio: Charles H. Purdum.
Sandborn Gravel Co., Sandborn, Ind.: Dayton Snyder, Abe Hart, Don Hart.
Terre Haute Gravel Co., Terre Haute, Ind.: Charles Connelly, Wayne Nattkemper.
Wabash Sand and Gravel Co., Terre Haute, Ind.: Lee R. Witty, L. F. Hart.
Western Indiana Gravel Co., Lafayette, Ind.: W. H. Sanders, K. R. Misner, M. A. Neville, H. A. Gray, W. R. McDonald.

(OTHERS)

Court Alfs, Barrett Co.; E. C. Bauer, Kensington Steel Co.; M. F. Beisber, *Pit and Quarry;* W. H. K. Bennett, Chicago; William Beninger, A. Leschen & Sons Rope Co.; Jack Hays, Pre-Coat Co.; William Holland, Indiana Highway Construction Co.; Thomas Kelley; W. B. Lenhart, ROCK PRODUCTS; I. C. McDonald, Standard Oil Co.; W. T. McDonald, manufacturing agent; J. E. McNally, Raybestos-Manhattan Co.; Perry Nagle, American Manganese Steel Co.; Clark Young, Cincinnati Rubber Co.

Kansas City Sand and Building Materials Concerns Merge

EFFECTIVE January 1, the Peck-Thompson Sand and Material Co., Kansas City, Mo., was organized as a merger of the Peck-Thompson Sand Co. and the Peck-Woolf Cement Co. The Peck-Thompson Sand Co. was a producer of Kaw river and Missouri river sand and the Peck-Woolf Cement Co. a building supply dealer.

The merger is interesting as representative of a well-defined policy on the part of many city sand and gravel producers in the

Frank W. Peck

section west of the Mississippi river to expand their business to include masonry building supplies, and sometimes all building supplies.

The new concern is a Delaware corporation financed by the issue of 1250 shares of class A common, and 1250 shares of class B common.

Frank W. Peck, former president of the Peck-Thompson Sand Co., a director of the National Sand and Gravel Association, is president of the new company. Frank C. Peck is vice-president; William P. Woolf, vice-president, and H. F. Thompson, secretary. The general offices are 505-10 Railway Exchange building, Kansas City, Mo.

France Stone Co. to Rebuild Bascom (Ohio) Plant

PLANS for an extensive building program at the France Stone Co.'s quarries at Bascom, west of Tiffin, Ohio, were announced recently. Frame quarry buildings will be replaced with a three-story steel structure, housing new machinery. A new office building will also be erected next year, it was stated.—*Bellevue* (Ohio) *Gazette.*

New York Sand and Stone Producers May Unite

AT A MEETING of the Empire State Sand and Gravel Association, Rochester, N. Y., December 16, 1930, the principal subject discussed was a project to combine this association with the New York State Crushed Stone Association. A number of prominent producers are interested in each industry and no doubt the attempt to bring the associations together will proceed.

The following officers were elected: President, C. W. Maxwell, Albany Gravel Co., Albany, N. Y.; vice-president, H. N. Snyder, Buffalo Slag Co. (which owns the former J. E. Carroll Sand Co. plants), Buffalo, N. Y.; secretary-treasurer, R. M. Kelley, Eastern Rock Products, Inc., Utica, N. Y.

The Buffalo Slag Co. is interested not only in slag, sand and gravel, but in crushed stone also, through its subsidiary, the Federal Crushed Stone Co., Buffalo. The Eastern Rock Products, Inc., is a considerable producer of crushed stone as well as sand and gravel.

Ohio State Sand and Gravel Producers Association Holds Annual Meeting

AT THE annual meeting of the Ohio State Sand and Gravel Producers Association at Columbus, Ohio, December 18, J. J. Gorman, general manager of the Zanesville Washed Gravel Co., Zanesville, was elected president; Stephen Stephanian, vice-president and general manager of the Arrow Sand and Gravel Co., Columbus, vice-president; Albert E. Frosch, general manager of the Eastern Ohio Sand and Supply Co., East Liverpool, secretary. Guy C. Baker, vice-president of the American Aggregates Corp., Greenville, was re-elected executive secretary. About 60 producers attended the meeting.

Mississippi Association Elects Officers

THE Mississippi Sand and Gravel Association elected the following officers at its recent annual meeting in Columbus, Miss.: T. W. Maddox, Brookhaven, president; re-elected; L. T. McCourt, Columbus, vice-president; N. W. Bockett, Hattiesburg, treasurer; R. E. Stamps, Brookhaven, recording secretary; C. F. Harris, Columbus, W. T. Hilton, Mendenhall, Herbert Gills, Hattiesburg, R. N. Kinard, Jackson, directors, and L. E. Puckett, New Albany and R. M. Waters, Columbus, executive committeemen.

Wisconsin Gravel Project

A. A. LAUN, president of the Elkhart-Moraine Sand and Gravel Co., Milwaukee and Elkhart Lake, Wis., is reported to be considering the building of a new sand and gravel plant at Portage, Wis.

Foreign Abstracts and Patent Review

Ash Loss to Cement Clinker. Ash loss to the clinker in rotary cement kilns charged with filtered slurry varies in relation to length of the kiln, to design of the plant in reference to the distribution of the slurry at the charging place, to fineness of the pulverized coal, to ash content of the fuel and to procedure in the burn. H. Moschitz relates that two rotary kilns, about 50 m. in length each, and of simple design assuring unobstructed passage of the kiln gases, were fired with lignite mixed with a smaller proportion of pit coal, having an average ash content of 16.5% and a fineness of about 10% on the 4900-mesh metric screen. For a period of one week figures were obtained on the composition and amount of coal, raw slurry, clinker produced and free dust accumulating in the dust chamber, the analyses being as follows:

	Raw flour, kiln inlet		Coal ashes		Clinker		Free ash in dust chamber	
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Loss on ignition	36.02	.....	1.82	.....	1.34	.....	10.95	.....
Insoluble in HCl	.....	.....	.....	.....	0.27	0.27	.....	.....
SiO_2	12.43	19.43	41.80	42.57	20.36	20.63	26.65	29.93
Al_2O_3	4.36	6.82	21.30	21.69	6.97	7.06	11.16	12.53
Fe_2O_3	2.12	3.31	14.60	14.87	3.12	3.16	6.86	7.70
CaO	43.12	67.40	10.30	10.49	65.52	66.14	38.72	43.48
MgO	1.57	2.46	2.93	2.98	2.39	2.42	.....	.....
SO_3	0.30	0.46	4.80	4.89	0.11	0.11	.....	.....
Remainder	0.08	0.12	2.45	2.51	.....	.....	5.66	6.36
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Hydraulic modulus	2.26		.....		2.14			
Silicate modulus	1.91		1.16		2.01			

The slurry consumption per week was 1548 cu.m., which corresponded [theoretically] to 1,710,540 kg. of raw flour or 1,094,403 kg. clinker; 410,430 kg. coal was used, which at 16.5% ash content produced 67,721 kg. ashes. Assuming that all ash is taken up by the clinker, the clinker output would be 1,162,124 kg. But the actual production of clinker amounted to 1,122,890 kg. The loss due to the prevailing draft in the kiln amounted therefore to 3.38%, 2336 kg. of this free dust deposited in the dust chamber, so that the balance of 36,898 kg. passed out of the stack. Based upon the kiln and upon a second of time, the waste gases carried 30 grams of free dust.

According to the above figures, the mixing proportion is 100 parts clinker, based upon raw flour free of loss on ignition, to 2606 parts ashes. Accordingly, *the clinker has taken on 2.606%* ashes. The ashes taken on by the clinker amounted therefore to 42.2% of the total ash content of the coal, or, to 6.96% of the total amount of coal.

Since an analysis of the free ash leaving the stack was impossible, the author had to assume that the particles of raw flour carried along by the ashes were deposited mostly in the dust chamber and that the dust discharged consists of coal ashes. If this ash were of the same composition as that in the dust chamber, the loss of raw flour would be too great. According to the analysis of the dust in the dust chamber, of the raw flour and of the ash, the free ash has a mix of 1 part raw flour to 0.406 parts ashes. Accordingly, the 2336 kg. deposit in the dust chamber is a mixture of 1668 kg. raw flour and 668 kg. ash. From this the loss in clinker figures to be 0.136%, based upon the theoretical raw flour consumption. —*Tonindustrie-Zeitung* (1930), **54**, 91, pp. 1430-1431.

Action of Gypsum in Cement. F. Tippmann prepared this article on the action of gypsum, swelling and hydration, in 1929. He deals with the problem of determining by exact experiments if the raw gypsum rock or dihydrate being used as regulator of the period of set of cement can be replaced by anhydrite, and of determining its influence upon the strengths of portland cement. Slower setting periods could be obtained either by adding 2% dihydrate or 1% stucco gypsum (hemi-hydrate), or 2% gypsum (regenerated dihydrate) or 4 to 5% anhydrite. From 5 to 6% anhydrite gave good strengths and did not affect soundness, due probably to the lower reaction ability of the anhydrite with water, and due to its being ground easier and therefore finer, making the cement dense and increasing its strength. There is a sudden change in the period of set when increasing the additive anhydrite from 4 to 5%. In the lengthy discussion of the subject the results of investigations by Meade, Budnikoff, Hart, Berger and others are reviewed.—*Zement* (1930), **19**, Nos. 44, 45, 46.

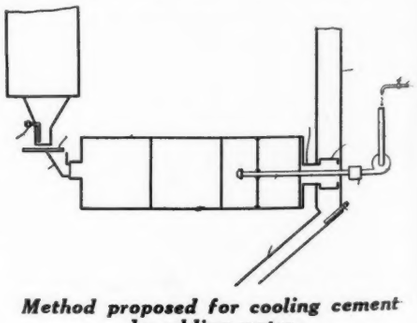
Examining Cement by Steam Pressure Readings. F. Krauss and G. Joerns made a preliminary report in 1929, and now present further details of their work in tracing the water released during the heating of the constituents of the portland cement, which are assumed as fixed with more or less certainty, and of the portland cement itself, by way of reading the steam pressure generated by the reaction of the cement specimens within a vacuum reaction vessel. The method of examination is based upon the physical-chemical law that every chemical combination has a very definite steam pressure characteristic of itself at a certain temperature and under otherwise similar conditions. This law applies also to the hydrates.

An isothermic examination is made by measuring steam pressure at a constant temperature or an isobaric examination is made by measuring at a constant steam pressure, the steam being evacuated after each reading and contents weighed; and the latter method is preferable for the hydrates. The manometer readings are entered upon a system of co-ordinates having water content values on the ordinate and degrees temperature on the abscissa. The hydrates are recognized by stepped lines in the system, and if there is no more hydrate there appears a gradually decreasing curve. This method can show to what constituents of a mix any absorbed water is given and in what quantities, and also whether crystallization has started, or whether there are colloidal processes, in which case there are no stages in the curve. The authors have started to take steam pressure curves of the hydrated constituents of portland cement and of the set cement itself. From the resulting curves, inferences are to be made as to the behavior of the water in setting, its position and behavior in the cement, and from this again the materials concerned in the composition of the cement.—*Zement* (1930), **19**, 45, pp. 1054-1055.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Grinding Cement Materials. The patentee describes a method of maintaining a comparatively low temperature in tube or ball mills while grinding portland cement, consisting of adding water to the material while it is being ground. The heat developed in grinding evaporates the liquid and



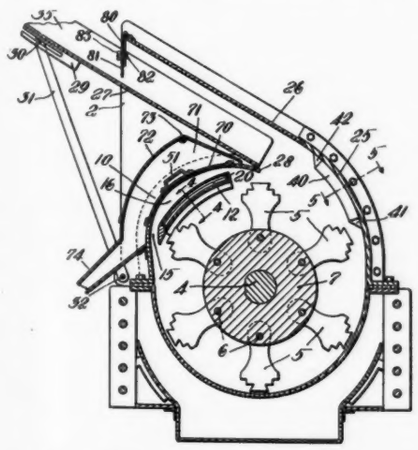
Method proposed for cooling cement by adding water

the temperature of the material is reduced. The liquid is added in such quantities and when the temperature of the material is such that the water is evaporated without absorption by the material. The accompanying sketch shows how the inventor carries out his ideas. *Carl Pontoppidan,* assignor to F. L. Smidth & Co. *U. S. Patent No.* 1,762,241.

Artificial Feldspars. The author proposes to head compounds of the bivalent and oxycompounds of bivalent metals with alumina and silica, causing them to react at temperatures of about 50 deg. C. below their fusion point. As an illustration, he suggests mixing MgO, 10 to 20%; Al_2O_3, 33 to 43%, and SiO_2, 40 to 50%, and heating to slightly above 1000 deg. C., at which temperature synthetic magnesium plagioclase forms. *Felix Singer. U. S. Patent No.* 1,759,919.

Cellular Gypsum. The inventor claims better control of liberated gases by using definite amounts of hydrogen peroxide (H_2O_2) and a catalizer such as blood flour. When water is added to calcined gypsum treated with the above reagents, oxygen is evolved and gives a cellular product.—*Gustave Adolph, assignor to the American Gypsum Co., Port Clinton, Ohio. U. S. Patent No.* 1,770,797.

Method of Discharging Hammer Mill. In the hammer mill shown here there is a bulge extending the full length of the casing. This forms a duct which is connected to a suction fan at the ends so that the suction removes fine materials. In another form



Illustrating a new method of discharging hammer mill

not shown the bulge is at the lower part of the casing and is covered with a screen.

When the hammer shaft is revolving the material follows around in the casing and it is thrown into the passage between the bulge and the casing by centrifugal force. The member which divides the bulge from the casing may be screened or it may have large openings or be covered, according to the product wanted. A removable cover forms the outside of the duct to permit wearing portions to be changed. The inventor claims that there is less wear when the material is removed in this way than there is where it is removed through a screen in the casing.—*W. J. Clement, U. S. Patent No.* 1,755,573.

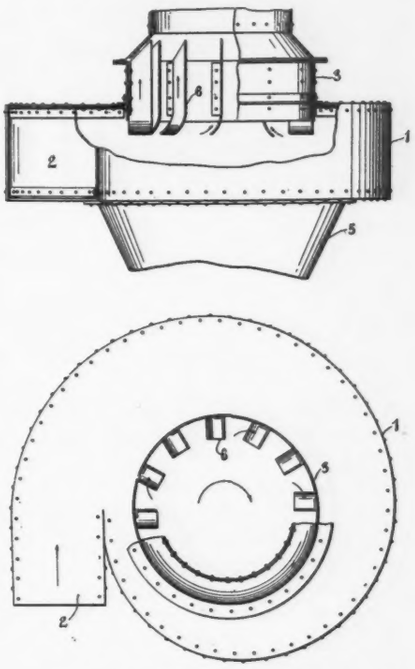
Improvement in Cyclones. When the air that has passed through a cyclone goes into the discharge pipe it has still some whirling motion. This offers more resistance in passing through the pipe than a straight flow would, as the path to be traveled is longer.

The improvement in the cyclone shown here is a method of changing the whirling flow in the outlet to a straight flow. The means used is a series of blades set radially in a chamber just below the outlet. The lower part of the blades is curved so as to receive the air without any shock.

In addition to reducing the resistance of the cyclone and hence the power required to operate it there should be a greater efficiency in dust catching. A change in the direction of the flow usually permits dust carried by the stream of air or gas to fall.—*J. Whitmore, U. S. Patent No.* 1,766,237.

Air Separation of Ground Material. The air separator which is shown here connected to a mill may be described as a double cyclone. In an outer cone the material is given a swirl by the usual tangential inlet. The coarse particles are thrown out and fall to a discharge which leads to the mill. But in doing this they fall through a rising current of air that removes any fines that may accompany them. All the air entering the outer cone passes through blades, which are set to give a whirling motion so that a second separation is made in the inner cone. The finest particles go out of the usual air outlet pipe in the top and are caught in a cyclone or any other form of collector. The coarse particles fall directly to the feeder of the mill, but the medium particles caught in the inner cone are held until their weight is sufficient to open a trap, this acting as a seal against the entrance of air to the inner cone from below.

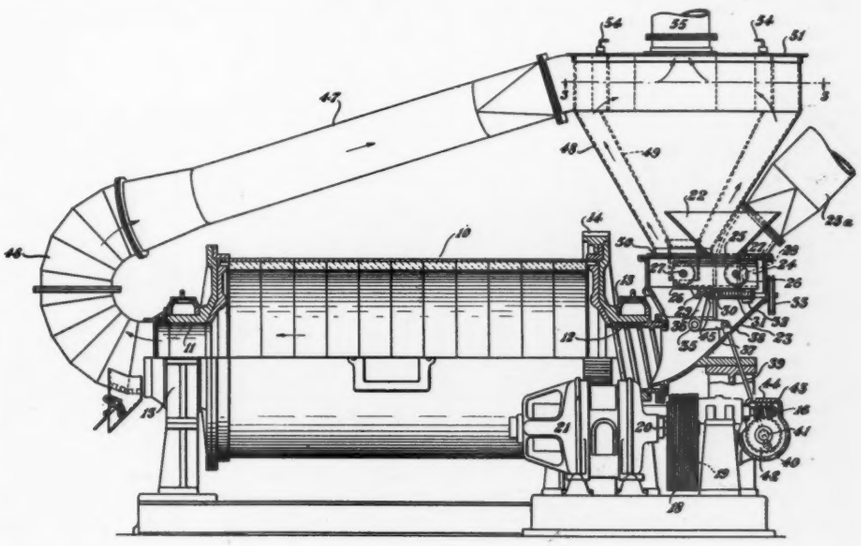
The feeder is an important part of the arrangement, as the air which sweeps the mill and then goes to the separator must pass through it. It is a trough feeder working in a closed box and the method of ad-



Improved cyclone has device for changing the whirling flow in the outlet to a straight flow

mitting feed without losing air pressure is described in detail in the patent.

A portion of the air entering the feeder is shunted to the passage between the two cones in the separator to lift the fines to the inner cone, but the greater part is used to carry the fines out of the mill.—*William H. Hartman, U. S. Patent No.* 1,770,850.



Double cyclone air separator has many excellent features

Cement Products

Ready-Mixed Concrete in the St. Louis District

General Material Company Now Operates Five Plants, Using More Than 100 Trucks for Deliveries

AMONG THE PIONEERS in the rather new field of ready-mixed concrete is the General Material Co. of St. Louis. Originally engaged in the handling of sand and gravel, this company enlarged its operations to include the manufacture of ready-mixed concrete by building a central mixing plant in 1927. This was later enlarged and others added until now in less than four years' time, five plants are being operated with a combined capacity of some 3000 cu. yd. of concrete per working day.

The plants are located in different sections of the city and delivery of concrete is normally made from that plant nearest the job, the trucks being moved from one plant to another as needed for the most efficient operation.

Four of the plants contain six mixers of the 2-yd. size, while the other is a smaller dry batching plant for use with mixer trucks only. Two kinds of service are offered; central mixing, with delivery in so-called "bath-tub" type dump bodies; and truck mixing or agitating en route to the job. Under certain conditions where the haul is very long or where the concrete has high water-content, the Transit mixer-trucks are used, but the plain bath-tub type body of the company's own design has been found very satisfactory for low slump concrete even with hauls of more than five miles.

Through careful control and the use of suitable equipment, every effort is made to turn out a uniformly high grade concrete and to deliver it to the customer in proper condition and when wanted. This policy has meant the scrapping of equipment from time to time as better methods have been developed, but is probably largely responsible for the increased use and confidence in this newer construction method.

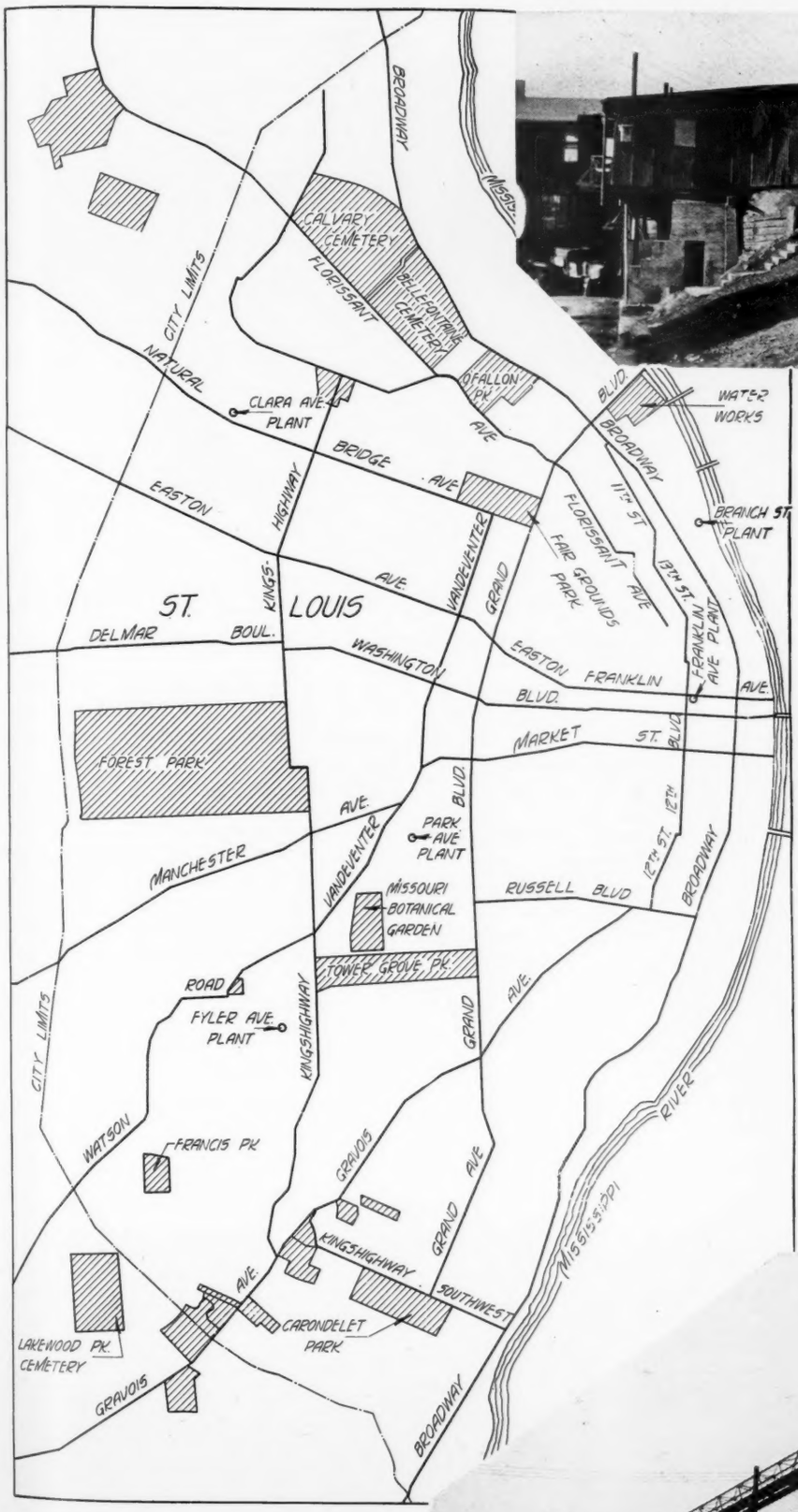
The area served includes not only the city itself (a lemon-shaped area roughly seven miles wide by fifteen miles long) but the rapidly growing section to the west and the industrial section east of the Mississippi river. Although the plants are so located that the haul is usually less than five miles, with a flat price for delivery anywhere within the city, much longer hauls have also been made successfully. It has been found that a truck-haul of one hour or even more is not injurious to the quality of the concrete. The five plants are known as Park avenue, Fyler avenue, Clara avenue, Branch street and Franklin avenue.

Park Avenue Plant

The Park avenue plant at 4101 Park avenue, centrally located in the Tower Grove district, was the first wet-mix plant operated by the company. It has since been enlarged so that it has a greater capacity than any of the others and because of its arrangement and construction, as well as its location, is the most used. Unlike most ready-mix plants it is what might be called a "horizontal" plant, in that there are no bins over the mixers, the batch of aggregates being brought in and dumped by truck to the mixer hopper. The only elevating of materials is in the handling of the aggregates from railroad cars or stockpiles by locomotive crane into the truck-batching bins.

Sand and gravel aggregates are received over the St. Louis and San Francisco railway to a double-track siding where they

Park Avenue plant—Loading points for trucks and for transit mixers



Map shows city of St. Louis and location of the various plants of General Material Co. At top of page is shown the Park Avenue plant, and below the Clara Avenue plant

are unloaded by two McMyler locomotive cranes (one a 30-ton and one a 25-ton, with 55-ft. booms and 1-yd. Blaw-Knox clamshell buckets). These put the material either into the truck-batching bins alongside the tracks or to stockpiles on the opposite side. Screen gratings over the tops of the bins keep out any refuse material. Six bins are used, four Blaw-Knox steel bins and two wooden bins, all equipped with weighing batchers. The cranes are able to unload up to 40 cars of material per day, and the ground space beyond the tracks provides storage for about 500 carloads.

The first bin contains sand and the next four the different sizes of gravel aggregates, while the last of the six bins is used for crushed stone. The latter material is trucked in from local quarries and handled to the bin by the locomotive crane. The weighing batchers under the sand bin and the first gravel bin are each equipped with a Howe beam scale and "Weightograph" attachment, while the other four have Mid-West automatic dial scales. The bins are arranged in a row with space enough between so that it is not necessary to drive under all of them, and a wide concrete driveway extends around to the mixer hoppers. Two or three of the bath-tub body dump trucks are used for handling the aggregates from the batching bins to the mixers, traveling in a circle, and drawing sand from the first bin, then coarse aggregate from one of the others,

General view of Park Avenue plant, General Material Co., St. Louis, Mo Showing

and dumping the batch to any one of the mixer hoppers.

Two 2-yd. Ransome mixers are used, and also a separate hopper for charging Transit mixer-trucks. These are all arranged so that the trucks which haul concrete are loaded at the street level from these three separated loading points.

Each mixer is operated on a 2-minute mixing schedule, or slightly less than a 3-minute cycle, which with an average batch of 2¼ yd., gives a capacity of 900 cu. yd. per 9-hr. day for the two mixers. An additional 200 yd. per day from the Transit-mixer loading gives this plant a capacity of about 1100 cu. yd. per day.

The cement is received in carload lots in sacks and is unloaded either to the mixer platform directly or to a storage warehouse. This unloading is done by piling the cement sacks on to skids or platforms holding 40 bags each, which are moved by a Lakewood electric storage battery lift truck. In this way the cement is easily and quickly moved as desired to any of the mixer hoppers. The truck is kept charged by being hooked up every night to a small motor generator charging set with an automatic cut-off, and has been found satisfactory for this work.

In order to conform to the municipal regulations governing all concrete work done for the city, each carload of cement is given a "lot number" which is noted on the delivery ticket of each batch and provides a record and check on the cement used, as well as being helpful in maintaining a daily inventory. The cement warehouse is divided into a number of separate compartments with doors so that if the cement is to be stored for a short time, each carload is put into a separate compartment and the doors sealed until used. Several different kinds of cement are kept on hand to meet the demands of the different users, so that in connection with the skids and lift truck any kind of cement may be used at any mixer on a moment's notice. The required number of sacks of cement are added by hand to the batch in the hopper, the empty sacks being later put through a bag cleaning machine and then bundled for return.

By reason of the simple and direct manner in which the materials are handled, this plant is exceptionally flexible, since it is possible to change instantly for any batch either the size of aggregates, kind of cement, or proportions.

For winter operation each batching bin is enclosed and is heated with steam coils, one of the locomotive cranes being used to pro-

At left, truck dumping to mixer hopper; and at right lift truck for moving cement at Park Ave. plant

Showing truck loading point on the left and the batching bins at the right

vide steam for this purpose. The water used in mixing is also heated, this being done by automatic equipment located near the mixers. Here a water tank with steam coils running through it is arranged with a thermostatic control, which opens or closes the steam valve to keep the water at a certain temperature. Steam for the purpose is provided by a small Bryant gas-fired boiler with a regulator on the burners which is operated in turn by the steam pressure. Low pressures are used, and the condensate in the coils drains back to the boiler so that the same water is used continuously, with practically automatic operation.

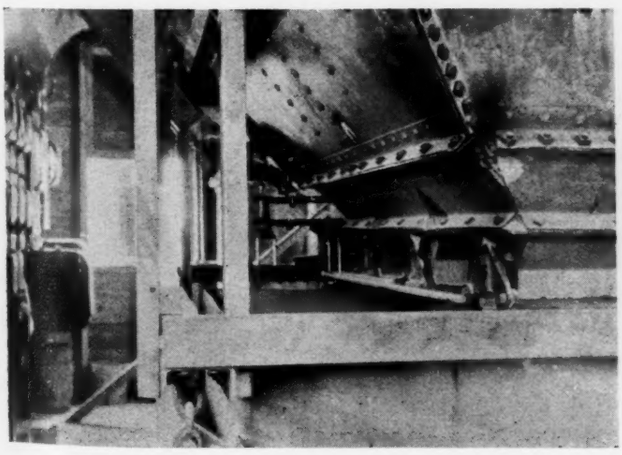
The water used in mixing is measured and admitted to the mixer through a quite special and unique valve arrangement which gives complete automatic control. This scheme was developed by the company's own organization and will be described in more detail further on.

A new garage of attractive appearance and substantial construction with poured concrete walls and floors, steel sash, steel roof trusses and composition roof has just been completed at this plant. It includes a heating plant, paint shop, machine shop, drivers' room, etc., and will be used for storage and repair.

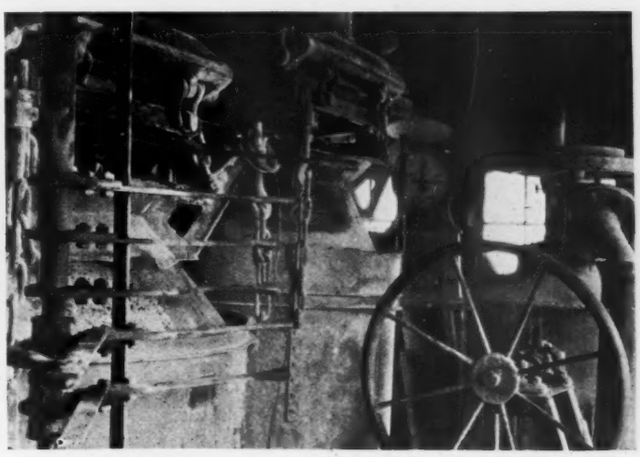
Fyler Avenue Plant

The Fyler avenue plant, located at 4999 Fyler avenue, about three miles south and west of the Park avenue plant, was built in 1929 and is of steel and concrete construction and arranged for mechanical handling throughout. It contains two 2-yd. Ransome mixers and has a capacity of 900 cu. yd. of concrete per 9-hr. day. The sand and gravel aggregates are received over the Missouri Pacific railway in bottom-dump cars which are emptied from a double-track trestle to an enclosed storage space below. This space is divided into five compartments for the different materials and sizes and provides a storage for about 350 carloads. Below it is a concrete tunnel with top openings and bin gates and a 30-in. by 385-ft. belt conveyor carrying out to a short cross belt conveyor at one end, which in turn delivers to an inclined 30-in. by 285-ft. belt conveyor carrying up to the bins over the mixers. Roller bearing idlers furnished by the General Conveyor and Mfg. Co., St. Louis, and 7-ply U. S. Rubber Co. belting are used on these conveyors.

The crushed-stone aggregate is received by truck from local quarries and dumped to a hopper at the end of the storage space, from which it is carried up to the end storage compartment on a 24-in. belt conveyor arranged with a movable tripper, this conveyor being furnished by the Stephens-Adamson Manufacturing Co.



Aggregate hoppers and weighing hopper at Franklin Avenue plant



At Fyler Avenue plant—Weighing hoppers, with levers to operate gates and band wheel for water

From the head of the inclined conveyor at the top of the bins the material is fed to any compartment in either of the two 160-ton capacity 4-compartment Johnson Octo-bins by means of a two-way spout and a turn spout over the center of each bin.

The tunnel arrangements and signaling devices used in handling these materials from the storage up to the bins are of interest. Double-quadrant, self-closing gates, each with one operating lever, are used to feed the belt conveyor in the tunnel. Each set of bin gates under the five different aggregate compartments is painted a different color, and near the middle of the tunnel is located an electric siren and a bank of electric lights of five different colors corresponding to the bin gates.

Thus the man on top of the bins and

H. F. Thomson, vice-president

in charge of filling them signals to the man in the tunnel when he wishes to change from one material to another by sounding the siren and lighting the lamp indicating the new size wanted. The tunnel man then signals back by pressing a button and makes the change, allowing a proper interval on the belt so that the man above may make the spout change. The tunnel is well lighted and drained with ample room to get around.

Cement is received by rail in bulk on another track alongside the plant and is unloaded to either of two sets of steel bins, one set on each side of the plant for each mixer, and each unit consisting of an enclosed bucket elevator and three storage bins. The cement is unloaded by power scraper to the elevator boot and is carried up and spouted to any one of the three bins. Each bin holds two carloads, so that cement is usually received two cars at a time, with a double "lot number" for each two-car shipment. Thus identification of the cement used in each batch is maintained in practically the same way as at the other plants, and each bin is emptied before being refilled. In order to be sure this procedure is carried out, the bin gates are kept padlocked. A screw conveyor under each set of three bins carries the cement from any one of them to an enclosed bucket elevator and hopper from which it is weighed to the mixer. This duplicate layout, with a total of 6 bins, gives a storage capacity of 12 cars of cement.

A. C. Butterworth, president

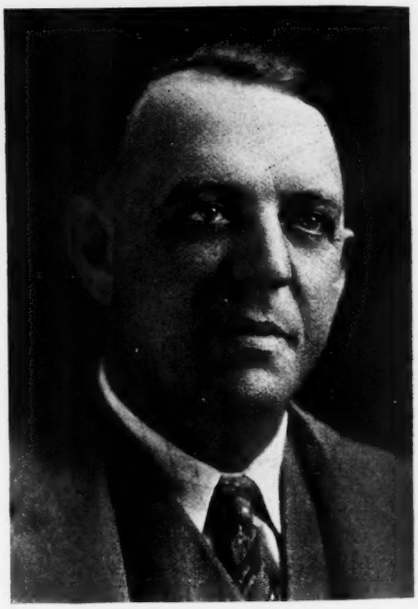
Batching to each mixer is done with three Johnson circular weighing hoppers, one for cement, one for sand, and one for coarse aggregate, each with a Mid-West dial scale, and for convenience all levers for operating the gates are located at one point. The same method of water measurement and control is used as at the other plants.

All equipment is driven by individual motors using 3-phase 60-cycle, 440-volt electric current. Allis-Chalmers 50-hp. and 75-hp. motors are used on the tunnel and inclined belt conveyors, and a 40-hp. General Electric motor on each mixer.

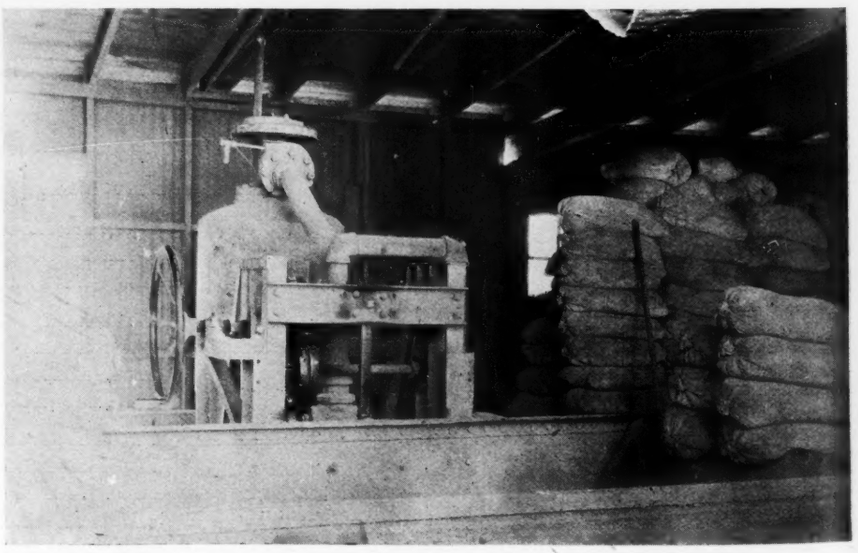
A modern 75-car garage of steel and brick construction provides for storage and repair work on trucks at this plant.

Clara Avenue Plant

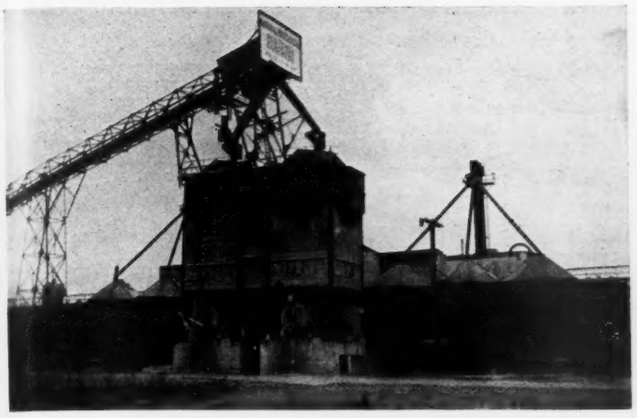
The Clara avenue plant, at 5617 Natural



Karl W. Lick, superintendent



Park Avenue plant—Mixer hopper and water tank with automatic measuring and feeding device



Fyler Avenue plant

Unloading cars at Park Avenue plant

Bridge avenue in the northwestern part of the city and about five miles from the Park avenue plant, is similar to the Fyler avenue plant just described, but smaller. It was also built in 1929 and has a single 2-yd. Lakewood mixer with a capacity of about 450 cu. yd. per day.

Aggregates are received over the Terminal railway and the cars emptied from a trestle to a ground storage of about 70 cars capacity, from which they are reclaimed by belt conveyor in a tunnel below. This conveyor discharges to an inclined belt conveyor carrying up to a 4-compartment Johnson "Octo-bin" over the mixer. Both conveyors are 20-in. wide with Jeffrey ball-bearing idlers.

Cement is received by rail in bulk and unloaded by power scraper to an enclosed bucket elevator, which delivers it to a second 4-compartment Johnson Octo-bin, each compartment of which holds one carload of cement. Below this bin two short parallel screw conveyors, each fed from either of two compartments, carry the cement to two weighing hoppers. With this arrangement any one of the four different lots of cement may be used as desired. The same system of lot numbers is used as at the other plants and each compartment is emptied before being refilled, this control being assured by padlocking the gates. Each conveyor motor is controlled by a mercoid tube switch connected up with the scale beam of the weighing hopper in such a way as to stop the conveyor when the desired load is reached. The sand and gravel aggregates are each weighed in a Johnson circular weighing hopper with dial scale. The plant is arranged so that a second mixer may be added later by rearranging the cement handling equipment.

Branch Street Plant

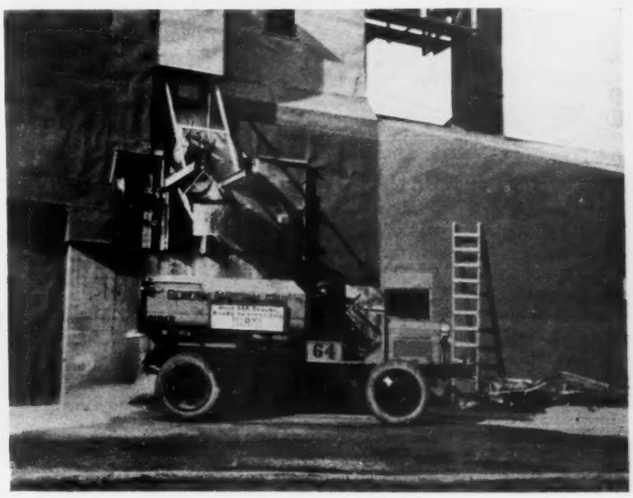
This is a dry batching plant arranged for charging Transit mixer trucks and is located at the foot of Branch street on the north side of the city near the McKinley Bridge. It was put into operation in 1928 and has a capacity of about 200 cu. yd. per day.

The aggregates are put into a 2-compartment Johnson bin by a locomotive crane with clamshell bucket, and are drawn by gravity to Johnson weighing hoppers with dial scales. The cement is handled in bags to the boot of a small elevator carrying up and discharging into the collecting hopper, from which the batch is spouted to the mixer truck. The whole operation is carried on from the ground by lever control.

Franklin Avenue Plant

The Franklin avenue plant, located at Twelfth street and Franklin avenue in the downtown district, has just recently been put into service. It contains one 2-yd. Ransome mixer with a 3-compartment Blaw-Knox steel batching bin above, and has a capacity of 450 cu. yd. of concrete per 9-hr. day.

The aggregates are received in railway hopper cars on a double track siding alongside the plant, sand on one track and gravel on the other. Here the cars are emptied into track hoppers provided with gratings to keep out any refuse, and the materials are then carried by belt conveyor and bucket elevator to the 3-compartment bin above the mixer. The turnspout on top of the bin is arranged with a small cable and windlass so that it may be turned to any compartment from below. The bin outlets are equipped with double quadrant type gates instead of the usual slide gates, and the batching is done in the collecting and weighing hopper which feeds the mixer. This is arranged with a 3-beam scale with indicating dial so that coarse aggregate, sand and cement are each weighed separately in the same hopper, the cement weight, however, serving only as a check on the bags used.



Views of Franklin Avenue plant of General Material Co.

The cement is handled in sacks, which are emptied to the boot of a small bucket elevator extending from the warehouse floor up to a short screw conveyor which carries it over to the weighing hopper. This elevator and conveyor are started and stopped by push button control by the operator, who also gives his orders as to the number of bags and kind of cement to the cement handlers below through a speaking tube. Of interest in connection with the weighing and charging hopper at this plant is the use of a tilting gate instead of the usual slide gate at the discharge point into the mixer. This gate has operated very satisfactorily.

The bins are fitted with steam coils for winter heating of the aggregates, and the mixing water is also heated by coils in the supply tank, steam being furnished by a 100-hp. locomotive type boiler mounted below and housed in so that its radiation also serves to heat the building and bins.

This plant is immediately adjoining the extensive subway and terminal building work of the Illinois Terminal Electric railway, over whose tracks the materials are brought in. A large amount of concrete from this plant will be used on the terminal project, the new Globe-Democrat building, and other adjoining building operations.

GENERAL MATERIAL CO.

Daily Cement Record

.....Plant for (date).....

Quantities of Cement in Bags

LOT NUMBER	ON HAND	RECEIVED THIS DATE
In warehouse, 6 A. M. on____		
In cars, do.		
Total to be accounted		
Used on day shift		
Balance		
Used on night shift		
Balance, 6 A. M. on____		
INVENTORY, 6 A. M. ON____		
In warehouse		
In cars		
Total		
Report any difference in check		

Signed_____

Each plant makes out a daily cement inventory

General

All orders for the delivery of concrete are handled through the Park avenue plant office where a dispatcher is in direct communication with all plants through a telephone switchboard at this point. Here a permanent record of each order as received is kept on a roll and a delivery order made out for the plant. This delivery order is then filled by the plant operator and a ticket made out to cover each batch. Each ticket is in quadruple, one being kept as a record and the original and two others going with the driver, who gives one copy to the purchaser, one copy to the inspector, and brings back the original, receipted by the purchaser. A daily cement record is kept, which is a continuous inventory, and also daily reports on aggregates, as well as a daily operating summary and sales report.

Of the 103 trucks operated by the company 63 Hug trucks and 30 Pierce-Arrow trucks have bath-tub type dump bodies, most of these with Wood mechanical type rack and pinion dumping mechanisms. There are also eight Paris Transit mixer bodies, six of 3½-yd. capacity on White chassis and two 3½-yd. capacity on White chasses and two of 2½-yd. capacity on Hug chasses, and two Barrymore 1½-yd. bodies on Mack chasses.

In addition there are three special trucks: one tank truck for distributing gasoline from the Fyler avenue plant where it is received in tank cars; one for handling tires and other supplies and for general service work; and one with both electric and oxy-acetylene welding equipment. The latter is equipped to handle any emergency repair work out on the road; and also has a motor-driven electric welding outfit which can be plugged in on the power line at any of the plants.

Each plant has laboratory facilities for the use of its own men and of outside inspectors, where regular tests are made to insure the quality of the product.

Among the interesting features which have been worked out within the company's organization is the water measuring and feeding device, previously referred to, and which is used at all except the Branch street plant. At these plants a hand wheel, conveniently located on the operating platform, is used to open and close the gate between the batch hopper and the mixer, and is also connected through an ingenious arrangement of gearing with the inlet and outlet valves of the water measuring tank. Both displacement and syphon type Ransome tanks are used at the different plants for measuring the water.

Turning the handwheel in one direction to admit a batch first closes the inlet valve of the tank, then opens the outlet valve and

Form A 5M—9-30—J

GENERAL MATERIAL COMPANY

DELIVERY ORDER

Name	Date	Time Rec'd
Address	Deliver to	
Mix	No. cu. yd.	Consistency
No. loads	Bill	cu. yd. per load
Time first load leave	To arrive	Interval of loads
Cement	Stone	
R. Sand	Gal. add. water	
Gravel	Admix	

Order rec'd from_____ Charge_____ C. O. D._____

Routing_____

_____

_____ Order rec'd by_____

Material delivery order

GENERAL MATERIAL CO.

GENERAL OFFICE
605 Buder Bldg. CHestnut 0797
PLANTS 4101 Park Ave. GRand 7172
4999 Fyler Ave. RIverside 3004
5617 Natural Bridge Ave. EVergreen 2630

B

Load No._____ St. Louis, Mo._____ 19____

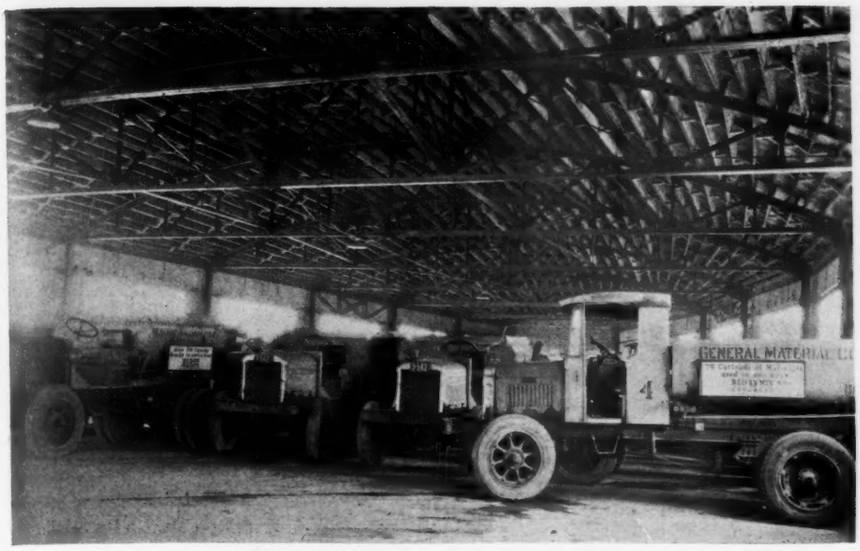
Name_____

Deliver to_____

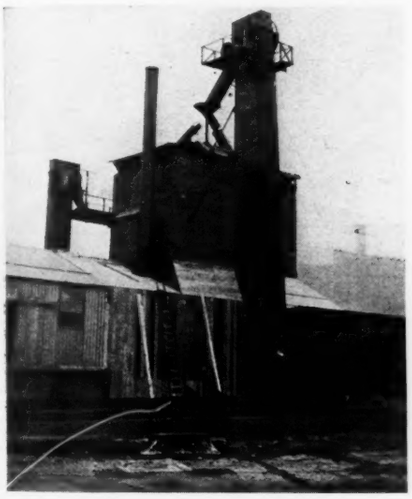
		LOT	NO.
	CU. YD. READY MIX		
TIME	Left Plant Sacks		
TIME	Dumped on Job		
Truck No.			

Received by_____

The sales slip is made in quadruple



Garage at Fyler Avenue plant



Track hopper and elevator at Franklin Avenue plant

then opens the gate, while turning it back reverses the cycle, closing the gate, then the outlet valve and then opening the inlet valve to refill the tank. Thus the two operations (admitting the batch to the mixer and adding the water) are combined into one and made positive and practically automatic, minimizing the chances of error as well as the physical effort required of the operator. The quantity of water for each batch is set on a dial above the tank. Also the opening of the outlet valve is timed so that some water is admitted to the mixer ahead of the batch and some following the batch, which considerably lessens the tendency of the materials to build up in the mixer and thus cuts down the amount of cleaning necessary.

The company has also developed and equipped some trucks with its own end gate for use with the bath-tub bodies. This is a rack and pinion operated gate in the center of the end plate with side plates in the rear corners to form a tapered discharge opening, and gives complete control of the dumping.

Particular attention is given to keeping the trucks in first class condition at all times. They are washed at least once daily, carefully cleaned weekly and painted each year.

The company's trademark, "Red-D-Mix," is painted on the side or tail gate of each truck, and printed slogans are also carried on both sides. These are used for their advertising value and are changed from time to time.

Some of the slogans which have been used are: "Over 100 Trucks Ready to Serve You"; "75 Carloads of Material Used in One Day"; "Quality Concrete, Each Load the Same"; "Delivered Warm in Cold Weather." Other advertising has consisted of a wall map of St. Louis showing the location of each plant, which has been distributed to all potential users of concrete in the district; a monthly bulletin, "The Red D," which has been issued regularly by the company for the past two years; and frequent copy in local builders' magazines and other media, the company being a firm believer in advertising.

The general offices of the company are at 605 Buder building. The officers are: A. C. Butterworth, president; H. F. Thomson, vice-president, and K. W. Lick, general superintendent. Mr. Butterworth is widely known among railroad and highway constructors, especially in the South. Mr. Thomson, who is western vice-president of the National Ready-Mixed Concrete Association, has been active in the ready-mixed concrete industry almost from its beginning. Mr. Lick was previously engaged in road and paving construction and was at one time with the Pennsylvania Highway Department.

Additions to Davison Cement Plant

CONTRACTS for additions to the Davison Coke & Iron Co.'s cement plant on Neville Island, Pittsburgh, Penn., have been awarded to the Rust Engineering Co. at a total cost of $100,000.

The additions will consist of six reinforced concrete cement silos with a storage capacity of 100,000 bbl., and a machinery building to house the cement pumps.

Erratum

OUR attention is called to the fact that in our issue of January 3, in reviewing the volume entitled "Diatomaceous Earth," by Robert Calvert, we listed the price of the book as $3. The cost of the book, however, is $4.

Branch Street plant of General Material Co.

New Machinery and Equipment

Spiral Separators for Removing Refuse from Coal

THE ANTHRACITE SEPARATOR CO., Hazleton, Penn., is manufacturing a line of spiral separators for removing slate and other impurities from sized coal, which may have an application in the preparation of aggregates.

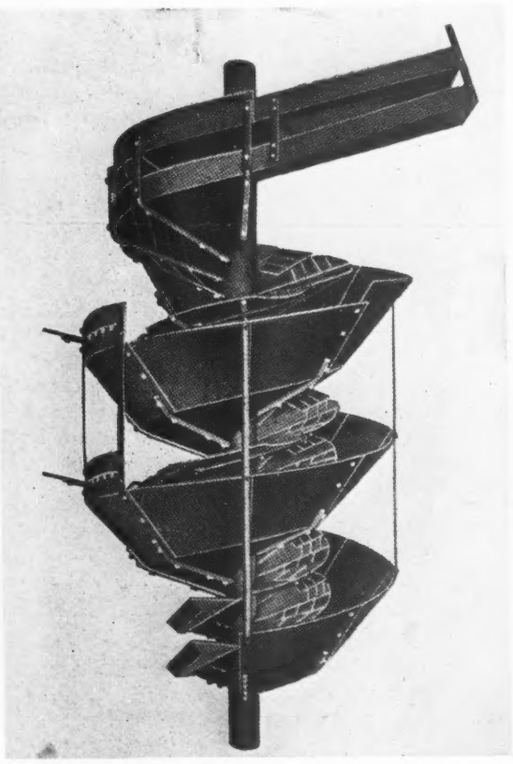
According to the description, these spiral separators remove free stone and slate from coal by taking advantage of the difference in the co-efficient of sliding friction between the coal and the refuse.

Anthracite can be handled either wet or dry, whereas bituminous and lignite coal must be handled dry.

The raw coal is fed on the feed chutes and slides down the spiral separating threads. These threads are fixed around a central post and designed with the correct pitch and form to allow the coal, due to its lower friction, to attain sufficient speed before reaching the bottom of the separator to be thrown centrifugally over the edges of the separating threads and into an outer flanged coal-collecting thread. The higher co-efficient of friction of the stone and slate refuse prevents it from attaining the requisite speed to slide over the separating threads. Instead it hugs the central post closely and is delivered in a separate inner chute at the bottom of the separator.

The separators are provided with levers by means of which the separating threads can be quickly adjusted. This adjustment simultaneously changes the frictional resistance and the effective diameter of the spiral to accommodate various veins of coal and changeable weather conditions, thus, it is claimed, enabling the operator to maintain a good separation even when the amount of refuse varies considerably, and giving him a wide range of control over the results.

Capacity of a spiral separator ranges from about eight tons per hour on pea coal to about 12 tons per hour on the larger sizes. On bituminous coal the capacity per separator is about two tons per hour less than for the corresponding sizes of anthracite.



Spiral separator removes slate and other impurities from coal

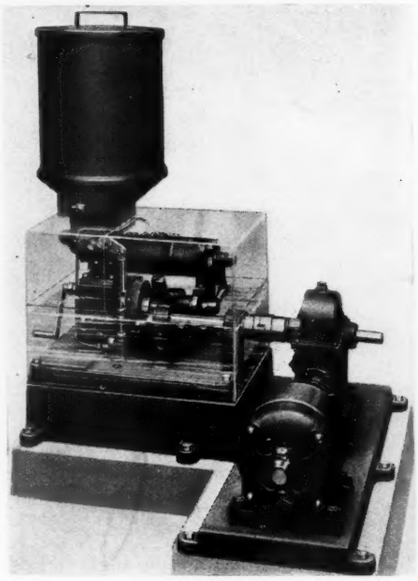
New Grease Pump for Handling Heavy Mill Grease

TO HANDLE the heavier and more viscous greases which are said to be the trend in present day equipment lubrication, the Hills-McCanna Co., Chicago, Ill., is marketing a new type of grease pump specially designed for pumping heavy mill grease.

The device is of simple and unusually rugged construction and according to the manufacturer, is capable of pressures not approached by any other device; and there is no dependence on air, hydraulic or spring pressures. Action is positive—it delivers measured quantities of lubricant to the bearing surface to provide a thorough protective film.

Grease is introduced into the feeding system of this Anderson mill type grease pump by means of a displacement pump operating a positive mechanical valve opened on the suction stroke and closed prior to the discharge stroke. A distributor head with the requisite number of leads is directly connected to the discharge side of the pump. The indexing of the head is secured by means of a ratchet attachment which allows indexing on the suction stroke of the pump and remains fixed during the discharge stroke, after which it indexes to the next lead and continues in order.

Delivery lines are attached directly to the distributor head and lead to the connections of the equipment bearings. A steam heating element is installed on the bottom of the hopper casting directly above the intake valve, to facilitate handling of heavy grease during cold weather. The grease hopper has a capacity of approximately 50 lb., and other sizes may be had on order.



Pump for handling heavy mill grease

A screen is installed in the grease hopper bottom beneath the steam heating element and above the intake valve to prevent foreign matter from entering the pump. Provision is made for adjustment of the stroke of the pump to regulate the amount of grease delivery and also on the speed of drive through proper adjustment of the number of teeth taken per stroke, which adjusts the delivery cycle. All running parts other than the motor and gear reduction unit are enclosed as a factor of safety and to protect the mechanism from dirt or scale.

The pump is built in sizes according to the number of feeds required. Present models consist of 4, 6, 8, 10 and 12 feeds per unit. Special sizes are made up to 24 feeds per unit. Where more than 24 feeds or leads are needed, two or more units may be connected with a common driving mechanism to secure the desired number of feeds. The pressure capacity of the Anderson pump, state the manufacturers, is sufficient to deliver grease under any bearing pressure to a maximum of 5000 lb. per sq. in.

Concentrated Mortar Colors

A HIGHLY concentrated mortar color has been developed by The Reardon Co., Cincinnati, Ohio, which has also de-

vised the sift-proof bag in which it is contained.

According to the manufacturer, these colors are revolutionary in content and package. It is claimed that the contents of the color are known and controlled to the extent of 99%, the replacement proportion in the mix is so low as to be almost negligible, and that as a result chemical reactions with foreign matter are eliminated, and a greater degree of hardness obtained in the cement.

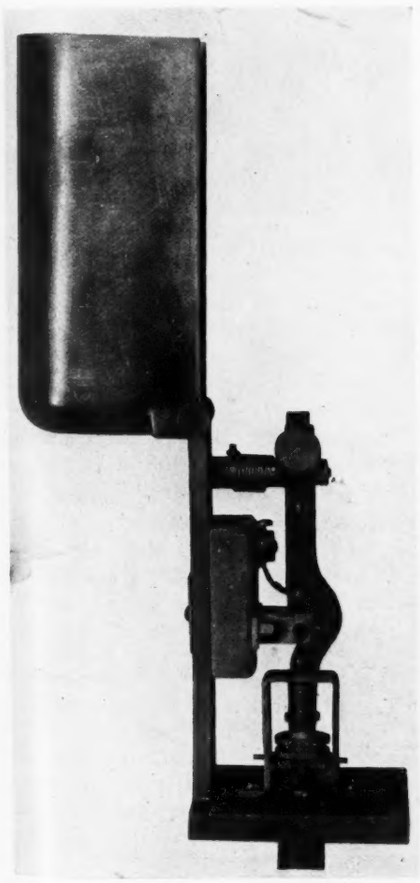
They are packed in sift-proof paper bags, six to the carton, and one small hand package of color is used to each sack of cement or lime in the mortar. It is said that uniformity of color is automatic.

New Thermostat Controls Melting Pots

THE GENERAL ELECTRIC CO., Schenectady, N. Y., announces a quartz rod thermostat for controlling the temperature of soft metal melting pots for use with lead, tin, babbitt, solder, etc.

The thermostat consists of an enclosed switch and a nickel-chrome iron tube extending from its base and surrounding a steel piston and quartz rod. The thermostat has a temperature range of 450-950 deg. F. and will control temperatures to within plus or minus 14 deg. F. of its setting. The contacts are designed to carry any current necessary to operate any standard automatic control panel.

It is an inexpensive device, and has a high degree of accuracy, it is claimed.



Quartz rod thermostat for controlling the temperature of soft metal melting pots for use with lead, tin, etc.

Novel Jaw Crusher

A NEW TYPE of stone crusher recently placed on the market by Mason Bros., Leicester, England, and called the "Unique," is indeed well named. It may be used either for granulating small stone or for breaking larger sizes, according to the manufacturers,

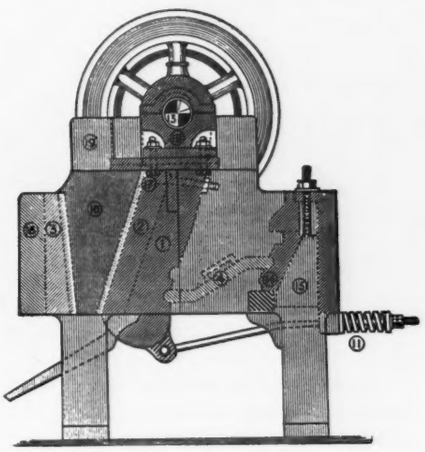


Fig. 1. As shown in the above illustration, crusher is arranged for coarse crushing

by a simple shifting of the main bearings and an adjustment of the block behind the toggle plate.

This is shown in the accompanying figures, Fig. 1 showing the machine arranged for coarse crushing and Fig. 2 for fine crushing. It will be noted in Fig. 2 that movable block 19 has been taken from the front of the main bearing and put behind it, throwing the bearing forward and decreasing the crusher opening, and that the adjusting block is raised to decrease the opening of the outlet. The block (15) is used to regulate the size of the stone being produced, and may be adjusted while the machine is running. It will also be noted that the arrangement of eccentric and toggle is such as to give rotary, or up and down, back and forward motion to the movable jaw, which it is claimed results in more work being done than in the ordinary jaw crusher.

Compact Multiple Manometer in Panel-Board Mounting

THE COMBINATION type multiple manometer for indicating high forced draft conditions, shown in the accompanying illustration, is manufactured by the Meriam Co., Cleveland, Ohio, and its neat appearance and compactness are outstanding features.

As explained by the manufacturer, neat appearance and compactness are sometimes difficult to obtain with the ordinary types of draft gages, where widely differing pressures must be indicated, because the principle of the gage depends upon the length of the tube and the liquid used. As a result, compactness may have to be sacrified to obtain the basic accuracy of the manometer principle.

The instrument illustrated is stated to be one of several made for panel mounting in

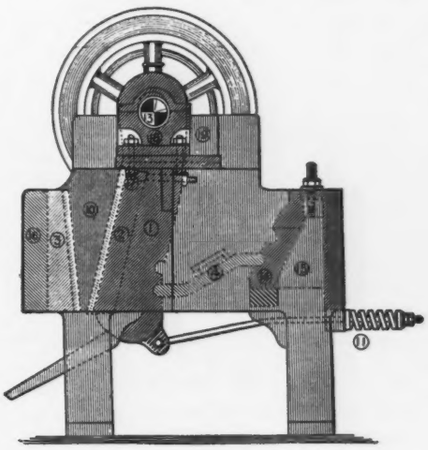
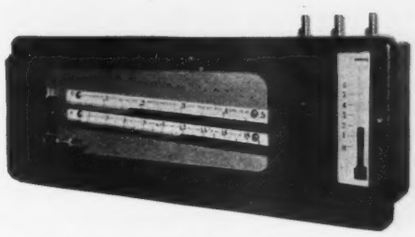


Fig. 2. Arranged for fine crushing. Block (19) it will be noted, is now behind the main bearing

the plant of the Gulf Co., Pittsburgh, Penn., for the measurement of forced draft furnace and stack conditions on pulverized coal-fired boilers. There are three draft gages in the combination instrument. One of these measures up to 6 in. water gage pressure, and is connected to the forced draft at the firebox. The second and third are of the inclined tube type and measure the draft at the fire arch of the boiler and at the stock outlet, respectively. They have a range of only 1 in. water gage. In order to get as large a reading as possible, red oil is used in the inclined manometers, while to reduce the length of tube necessary for measuring the 6 in. force draft pressure the liquid used in the vertical manometer is a special preparation having a specific gravity of 2.97—that is, somewhat heavier than that of hard drawn aluminum. This high specific gravity, it is claimed, permits the length of the tube to be reduced to a little over 2 in., and thus the entire apparatus is easily contained in a 17x5¼-in. polished aluminum case, and the fill-plugs are placed at the top of the instrument.



Multiple manometer for indicating high forced draft conditions

Better Business Bureau Movement for Betterment of Building Construction

By Julius Seidel

Chairman, Construction Industries Division of the Better Business Bureau of St. Louis

NOTHING worth while in this good world of ours just happens.

Fundamental causes appear that awaken the conscious mind and make us think. Nothing, barring agriculture, perhaps, has so awakened public interest as the effect of a sluggish market in building construction work upon economic conditions generally.

When we reflect on the sum total of actual building construction in the United States during active years, we must marvel at its immensity. Add to this sum the amount of investment represented by the output of plants of manufacturers of materials that go into homes, commercial structures, factories, office buildings, highways, bridges and the like, and we come to realize both the effect of activity and a halting in building construction on labor employment.

Explanation

THE Business Men of St. Louis, Mo., have co-operated in a movement that goes far to make the so-called construction industry a real industry, instead of a heterogeneous collection of industries—or often warring interests. It is hoped that the business men of other localities will do likewise.

The rock products industry should be vitally interested in this accomplishment because it is a large part of the construction industry and its future depends largely on such progressive steps. It is also interested in this particular case—the first—because rock products business men have had a large part in its initiation.

UNCONTROLLED CONDITIONS. Approximately three years ago building operations under the mass production era were getting beyond control. There was even then in the minds of many just cause for alarm as to the effect on future years.

Building construction had become complex. New thoughts as to materials best fitted for modern structures, with due regard for public safety, economy, durability, and sanitation were evolved and the resulting products offered. Whether good or bad, they were in active competition with established lines and practices. Specialization, technical information and research created a new competition. It mattered not so much what competition in the same line was doing; the greatest concern lay in the realization that newer substitutes were vying for the trade of long established materials and practices without proper regard for the interest of, and the effect upon, the public.

Intensive competition for the supremacy of one to the exclusion and destruction of others may lead to a condition detrimental to the whole industry.

PRELIMINARY ORGANIZATION. It was at that time that a few men identified with the building construction industry began to informally discuss conditions and concluded that the construction industry needed a comprehensive, interlocking, constructive policy as a basis for the continued interest and development of the building business. The efforts of the contracting trades and material dealers were, in most instances, too intensely concerned in their own business or association to weigh or comprehend the interlocking responsibility to the general industry, namely, building construction resulting in a COMPLETE BUILDING.

Investment in building securities with its present diversified ramifications needed especial consideration, as the interest of the investing public in safe building collateral was all-important.

It dawned upon those various men of the industry in their first meetings that until each interlocking group realized and accepted its responsibility to the subject as a whole, complete unit, little progress could be made.

In the middle of 1928, several preliminary meetings of material men and contracting interests were held in St. Louis, Mo. In these caucuses the idea was formulated that we must first consider subordinating all interests in the building field to the basic interest of the consumer. Here was a common banner under which all building interests could rally, discuss their problems as they related to each other, and to the consumer, and solve them.

Then and there we placed our plans, aims and purposes before the Better Business Bureau of St. Louis, realizing that they were the exact organization who worked primarily in the public interest. They were asked to accept the responsibility, and they did.

PERMANENT ORGANIZATION. This, then, was the beginning of our movement and the construction industries division of the bureau became a reality. The bureau, being a fact-finding organization with nothing to sell, could act disinterestedly in accomplishing our purpose. It was not unmindful of the fact that the construction business, just as other lines of business, was also beset with impositions, deceptions and misrepresentations against which the public could and should be protected, and that through public education, the dissemination of building facts, and the co-operation of reputable building institutions, better construction would ensue.

BASIC STANDARDS. The first problem seemed to be the necessity of introducing some standard of measure, or yard-stick, to evaluate the investment in a building. Our counsel and consulting engineer could find no "Blackstone" on the complete component parts of an entire dwelling. The job seemed to be one of compilation and analysis through which all factors could be welded together to make up a finished building, erected and ready for occupancy. A text-book of the so-called law of fundamentals, covering every major line of materials and contracting groups, written in the language of the layman, was our objective. Not until that work was done would there be a minimum of standards to enable the Bureau to separate the wheat from the chaff and place building in a class of good, bad or indifferent construction.

GROUP ORGANIZATION. To accomplish this aim, to prepare such a treatise, meant organizing the respective groups to reach a common understanding as to what should be the law of Good Practices.

Undismayed by this enormous responsibility to the industry, to the groups, and to the public, we decided on preparing and issuing Good Practice Specifications. Progress was necessarily slow. We organized material dealers, contracting groups and, quite naturally, included the professional men, namely architects, engineers and later the financial interests, that is, Mortgage Bankers and Building and Loan associations. To date our organized groups comprise three professional, three finance, six contracting and eleven materials.

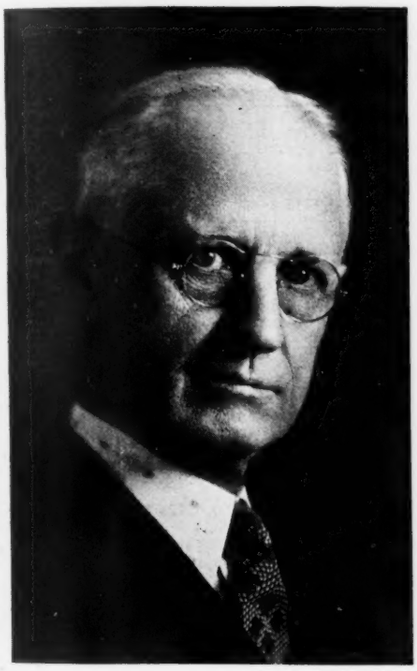
We agreed upon all major lines for which the writing of Good Practice Specifications were necessary.

TECHNICAL SUPERVISION. It then became necessary to select and engage a technical expert of ability, qualified to call meetings of, preside at, and advise with, groups when the specifications were discussed. We needed a man qualified to intelligently consider not only the materials or mechanical work under discussion, but also to know, understand and weigh the interlocking relative responsibility of all the groups in modern construction. We were fortunate in securing the services of William C. E. Becker, whose reputation and ability as a consulting engineer were recognized and unquestioned.

Men engaged in building construction can fully appreciate the untiring patience it

required to meet the men in the different groups of materials and contracting and have them arrive at definite conclusions. Each specification was prepared and submitted, carefully read, analyzed, discussed and frequently resubmitted before the final approval of the 23 different group chairmen was secured. The writing of the 27 specifications required in the erection of a complete dwelling is the result of our labors. We have called it "Good Practice Specifications for Small Dwellings."

Our determination to create an uplifting basis—through these technical specifications—drew to us the help, as you see, of many



E. J. Krause, president of Columbia Quarry Co., member of the Council on specifications for building construction

other groups who had not been organized, yet offered every encouragement and help to reach our objective.

The Better Business Bureau, under whose banner and guidance we are operating, was constantly consulted in order that the public interest might be inculcated in this move. Its approval of our work assures all of us that public opinion can be molded to constructively build increased good will for our industry.

Our best men accepted the ideals of the bureau which reads: "To promote and maintain fair competition and dependability in advertising and selling and to protect the public against misrepresentation, deception and fraud."

BACKED BY BUSINESS LEADERS. The Bureau, in conformity with its by-laws elected six members of our Division to become directors of the general Better Business Bureau board, this board totaling 65 of St. Louis' outstanding business executives. Thus we have the force of the business world to assist us in determining proper policies and enables them to get our perspective and viewpoint, and we in turn theirs. Thus do we add and receive a most broadening insight into general good practices for our industry.

SPECIFICATIONS PUBLISHED IN BOOKLET FORM. We have now produced this booklet of Good Practice Specifications. As is always the case, good work in any line lifts that particular business to a higher plane. Although the many profit, not always do all render either moral or financial support. So it has been with our Division.

The completion of the Good Practice Specifications has involved an investment to date for the common good, in actual moneys expended of about $20,000. To this we should add the time of the executive council which has been given gratuitously for a common cause. The value of their time and efforts is well nigh incalculable. We have done a local job with a national significance and are offering other cities an example to do likewise. With few exceptions the fundamentals are basic anywhere.

COVERING COMPLETE FIELD OUR AIM. We concluded to cover the field of small dwellings first, as that field needed urgent help and involved the greatest public interest. Let me say that the basic elements in good construction fully cover the field as to method of procedure on any kind of structure, small or large, as to elements of safety, permanence and attributes in material and workmanship inherently essential in all good building construction. Our booklet today covers one field as a start, namely, small homes. Our council intends to proceed with equal zeal to other problems vital to our industry.

France Stone Co. Installing Washing Equipment

WHEN the North Baltimore, Ohio, quarry of the France Stone Co. reopens for operations, possibly within the month, it will produce a finer grade of stone than ever before, and with that better quality will come a revival of the industry here, stonemen predict.

Old equipment of the quarry is under the process of rebuilding now, with a new screen and washing device being installed to wash all of the stone quarried in the future. Water from the reservoir in the quarry will be pumped to the crusher for the washing. A byproduct of the washing in future years, if not in 1931, will be a sand similar to lake sand.

Storage at the quarry is lower now by over 100,000 tons than it was at this time last year, indicating that the quarry must reopen for crushing as early as possible under the new equipment.

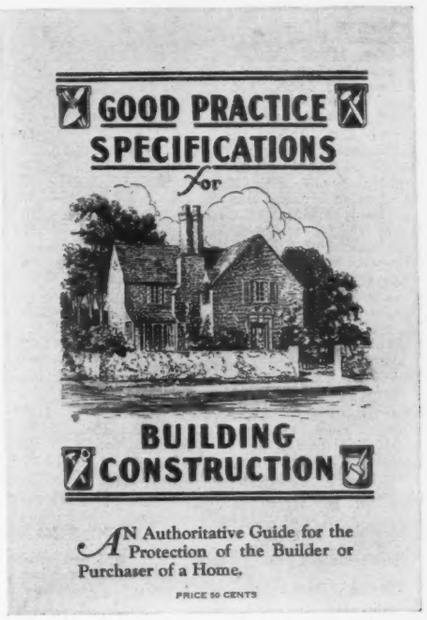
S. H. Friesner is superintendent of the quarry.—*North Baltimore* (Ohio) *Beacon.*

St. Louis Helps Better Building

FOR THE BENEFIT of those interested in home building or buying, the Construction Industries Division of the Better Business Bureau of St. Louis, Mo., has just issued after long and careful study a 95-page booklet entitled "Good Practice Specifications for Small Dwellings."

The twenty-seven specifications contained in it cover practically all materials and workmanship entering into the building of small homes and define good practice along these lines. Among the subjects included are concrete, masonry, brickwork, steel, woodwork, plastering, roofing, glazing, plumbing, painting, heating, electrical work, hardware, etc.

The booklet represents a great deal of work on the part of the executive council, made up of representatives of the various lines mentioned and of architects, engineers and contractors, and is worthy of special



commendation. In working out these specifications the advice and criticism of the various associations, trades and professional bodies were obtained, so that they represent in their final form the best thought and judgment of experienced men in each field.

Worked out in this way and passed on finally by the executive council representing the construction industry of the district as a whole, these specifications represent a distinct step forward in the simplification and standardization of small house construction, and the lead taken by St. Louis in this matter might well be followed by other cities in the interests of good construction.

It is understood that this will be followed later by similar specifications covering larger building operations.

Among those serving on the council was E. J. Krause, president of the Columbia Quarry Co., who represented the crushed-stone producers.

The Rock Products Market

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.15	1.15	1.75	.....	1.75	1.75
Buffalo, N. Y.	.....	1.05	1.05	1.05	1.05	1.05
Erie, Penn.	.80	1.00	.....	.....	.....	.....
Leeds Jct., Scarboro, Me., and Milton, N. H. (b)	.....	.50	.....	1.75d	1.25	1.00c
Machias Junction, N. Y.	.75	.75	.75	.....	.75	.75
Montoursville, Penn.	1.00	.75	.60	.40	.40	.40
Georgetown, D. C.	.55	.55	1.00	1.00	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.30	.20	.20	.35	.35	.40
Attica, Ind.			All sizes .75–.85			
Cincinnati, Ohio	.55	.55	.80	.80	.80	.80
Columbus, Ohio	.75–1.00	.50– .75	.60– .75	.60– .75	.60– .75	.60– .75
Des Moines, Iowa	.40– .70	.40– .70	1.50–1.85	1.50–1.85	1.50–1.85	1.50–1.85
Dresden, Ohio	.....	.60	.70– .80	.75	.75	.70
Eau Claire, Wis.	.....	.55	.65	1.00	1.00	.....
Elkhart Lake and Glenbeulah, Wis.	.45	.50	.50	.60	.50	.50
Grand Rapids, Mich.	.40	.40	.70	.70	.70	.70
Greenville, Ohio	.50– .70	.40– .60	.50– .60	.50– .60	.50– .60	.50– .60
Hamilton, Ohio	.65– .75	.65– .75	.65– .75	.65– .75	.65– .75	.65– .75
Hersey, Mich.	.....	.40	.....	.70	.70	.70
Humboldt, Iowa	.....	.45	.....	.....	1.25	.....
Kalamazoo, Mich.	.....	.45	.50	.60	.75	.....
Kansas City, Mo.	.70	.70	.80	1.50	.....	.....
Mankato, Minn.	.55	.45	1.25	1.25	1.25	1.25
Mason City, Iowa	.50	.50	.85	1.25	1.25	1.25
Milwaukee, Wis.	.....	.86	.86	.96	.96	.96
Minneapolis, Minn.	.35	.35	1.35	1.35	1.35	1.25
Oxford, Mich.	.25– .35	.20– .30	.30– .40	.55– .75	.55– .75	.60– .75
St. Louis, Mo.	.45– .75	.45– .85	.50– .90	.50– .90	.50– .75	.50–1.00
St. Paul, Minn.	.35	.35	1.25	1.25	1.25	1.25
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Waukesha, Wis.	.....	.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	.50	1.00	1.00	1.00
SOUTHERN:						
Brewster, Fla.	.40	.....	.....	.....	.....	.....
Charleston, W. Va.	.70	1.25	1.25	.....	.....	.....
Eustis, Fla.	.....	.40– .50	.....	.....	.....	.....
Fort Worth, Tex.	1.00	1.00	1.25	1.25	1.25	1.25
Knoxville, Tenn.	.70– .90	.80–1.00	.....	.....	1.05–1.20	1.05–1.20
Roseland, La.	.40	.40	.90	.75	.75	.75
WESTERN:						
Phoenix, Ariz.	1.25*	1.15*	1.50*	1.15*	1.00*	1.00*
Pueblo, Colo.	.80	.60	.....	1.20	.....	1.15
San Gabriel, San Fernando Valleys, Cal. (a)	.80	.70	1.20	1.20	1.20	1.20
Seattle, Wash.	1.00*	1.00*	1.00*	1.00*	1.00*	1.00*

*Cu. yd. ‡Delivered on job by truck. (a) Discount, 20c per ton if paid by 10th of month following delivery. (b) In carload lots. (c) Gravel, 2½-in. down to ¼-in. (d) ⅝-in. down to ¼-in.

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; per ton f.o.b. plant.

City or shipping point	Molding, fine	Molding, coarse	Molding brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.00	2.00	2.25	.....	.....	3.50	.....
Cheshire, Mass.			Sand for soap, 5.75–7.00			5.00	.....
Columbus, Ohio	1.35–1.50	1.25–1.50	2.00	1.25–1.35	.....	3.50–4.50	.....
Dresden, Ohio	1.15–1.50	1.00–1.35	1.25–1.50	1.00–1.25	1.25	.....	.....
Eau Claire, Wis.	.....	.....	.....	.....	.....	2.50–3.00	.....
Elco, Ill.			Amorphous silica, 90-99½% thru 325 mesh, 10.00–60.00 per ton				
Kasota, Minn.	.....	.....	.....	.....	.....	.....	1.00
Mendota, Va.			Flint, 8.00–10.00 per ton				
Montoursville, Penn.	.....	.....	.....	1.35–1.60	.....	.....	.....
New Lexington, Ohio	2.00	1.75	.....	.....	.....	.....	.....
Ohlton, Ohio	1.60	1.60	.....	1.75	1.60	1.75	.....
Ottawa, Ill.	.....	.....	.....	.....	.....	3.50	.....
Red Wing, Minn. (a)	.....	.....	.....	.....	1.50	3.00	1.50
San Francisco, Calif.	3.50†	5.00†	3.50†	2.50–3.50†	5.00†	3.50–5.00†	.....
South Vineland, N. J.			Dry white silica sand, per ton, 2.25				

†Fresh water washed, steam dried. *Damp. (a) Filter sand, 3.00.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Dresden, Ohio	.....	1.00
Eau Claire, Wis.	4.30	1.00
Ohlton, Ohio	1.60	1.60
Red Wing, Minn.	.....	1.00
San Francisco, Calif.	3.50	3.50

Glass Sand

(Silica sand is quoted washed, dried and screened)

Cheshire, Mass. (in carload lots)	5.00–6.00
Klondike, Mo.	2.00
Mendota, Va.	2.50–3.00
Ohlton, Ohio	2.40
Ottawa, Ill.	1.50
Red Wing, Minn.	1.50
South Vineland, N. J.	1.75
San Francisco, Calif.	4.00–5.00

Bank Run Sand and Gravel

Algonquin, Ill.¶ (½-in. and less)	.30
Buffalo, N. Y.—Sand, 1/10-in. down, 1.00; ¼-in. down, .85; gravel, all sizes	.75
Burnside, Conn. (sand, ¼-in. and less)	.75*
Fort Worth, Tex.¶ (2-in. and less down to ½-in. and less), for concrete, .70; for roads	.65
Gainesville, Tex.¶ (1½-in. and less)	.55
Grand Rapids, Mich.¶ (1-in. and less)	.50
Hersey, Mich.¶ (1-in. and less)	.50
Kalamazoo, Mich.¶ (1½-in. and less)	.35
Mankato, Minn.†	.70
Winona, Minn.—Sand, any size	.50– .60
York, Penn.—Sand, 1/10-in. down, 1.10; ¼-in. and less	1.00

*Cu. yd. †Fine sand. 1/10-in. down. ¶Gravel.

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations.

Portland Cement

	F.o.b. city named Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M.	.82½	3.30	.....
Atlanta, Ga.	.....	†2.15–2.19*	3.46¶
Baltimore, Md.	.....	†2.23–2.26*	3.53¶
Birmingham, Ala.	.....	†1.81–1.85*	3.12¶
Boston, Mass.	.46¼	†1.85–1.88*	3.24¶
Buffalo, N. Y. (d)	.48	†1.92–1.95*	3.13–3.22¶
Cedar Rapids, Ia.	.....	2.23*	.....
Charleston, S. C.	.....	1.89†	3.26¶
Cheyenne, Wyo.	.60¾	2.43	.....
Chicago, Ill.	.....	†1.92–1.95*	3.22¶
Cincinnati, Ohio	.....	2.14*	3.44¶
Cleveland, Ohio	.....	†1.87–2.04*	3.17¶
Columbus, Ohio	.....	†2.14–2.17*	3.44¶
Dallas, Texas	.....	1.90*	3.49¶
Davenport, Iowa	.....	2.14*	.....
Dayton, Ohio	.....	2.14*	3.44¶
Denver, Colo.	.66¼	2.65	.....
Des Moines, Iowa	.48½	2.29*	.....
Detroit, Mich.	.....	1.95*	3.25¶
Duluth, Minn.	.....	2.04*	.....
Houston, Texas	.....	2.00*	3.73¶
Indianapolis, Ind.	.54¾	1.99*	3.29¶
Jackson, Miss.	.....	†2.24–2.29*	3.54¶
Jacksonville, Fla.	.....	2.12†	3.46¶
Jersey City, N. J.	.....	†2.10–2.13*	3.40¶
Kansas City, Mo.	.50½	2.02*	3.32¶
Los Angeles, Calif.	.57½	2.30	.....
Louisville, Ky.	.55½	†2.07–2.12*	3.37¶
Memphis, Tenn.	.....	†2.03–2.29*	3.33¶
Milwaukee, Wis.	.....	2.10*	3.40¶
Minneapolis, Minn.	.....	2.27*	.....
Montreal, Que.	.....	1.60‖	.....
New Orleans, La.	.....	1.92†	3.22¶
New York, N. Y.	.50	†2.00–2.03*	3.30¶
Norfolk, Va.	.....	1.97*	3.27¶
Oklahoma City, Okla.	.60¾	†2.43–2.46*	3.73¶
Omaha, Neb.	.55½	†2.22–2.36*	3.52¶
Peoria, Ill.	.....	2.12*	.....
Pittsburgh, Penn.	.....	†1.92–1.95*	3.22¶
Philadelphia, Penn.	.....	†2.12–2.15*	3.42¶
Portland, Ore.	.....	‡2.40–2.50	.....
Reno, Nev.	.....	2.96‡	.....
Richmond, Va.	.....	†2.29–2.32*	3.59¶
San Francisco, Calif.	.....	2.24‡	
Savannah, Ga.	.....	1.89†	3.20¶
St. Louis, Mo.	.48¾	†1.60–1.95*	2.90¶
St. Paul, Minn.	.....	2.27*	.....
Seattle, Wash.	.....	1.50–1.75	2.40c
Tampa, Fla.	.....	2.00†	3.41¶
Toledo, Ohio	.....	*2.10–2.20†	3.50¶
Topeka, Kan.	.55¼	2.21*	3.51¶
Tulsa, Okla.	.57½	†2.30–2.33*	3.60¶
Wheeling, W. Va.	.....	†1.99–2.02*	3.29¶
Winston-Salem, N. C.	.....	2.44*	3.74¶

Mill prices f.o.b. in carload lots, without bags, to contractors.

Bellingham, Wash.	.....	2.25	.....
Bonner Springs, Kan.	.....	1.85	3.15¶
Buffington, Ind.	.....	1.70	.....
Concrete, Wash.	.....	2.65	.....
Hannibal, Mo.	.....	1.80	.....
Hudson, N. Y.	.....	2.37†	3.27¶
Independence, Kan.	.....	1.85	.....
Leeds, Ala.	.....	1.70	.....
Limedale, Ind.	.....	1.70	.....
Lime & Oswego, Ore.	.....	2.50	.....
Nazareth, Penn.	.....	2.15	.....
Northampton, Penn.	.....	1.75	.....
Richard City, Tenn.	.....	2.05	.....
Steelton, Minn.	.....	1.85	.....
Toledo, Ohio	.....	2.20	.....
Universal, Penn.	.....	1.70	.....
Waco, Tex.	.....	1.85	.....

NOTE: Unless otherwise noted, prices quoted are net prices, without charge for bags. Add 40c per bbl. for bags. *Includes dealer and cash discounts. †Includes 10c cash discount. ‡Subject to 2% cash discount. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c discount 15 days. ‖Includes sales tax. (c) Quick-hardening "Velo," packed in paper bags. (d) Also †1.82 per barrel.

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.25–1.30	1.25–1.30	1.25–1.30	1.25–1.30	1.25–1.30	1.25–1.30
Chazy, N. Y.	.75	1.60	1.60	1.30	1.30	1.30
Ft. Spring, W. Va.	.35	1.35	1.35	1.25	1.15	1.00
Frederick, Md.	.50–1.00	1.50	1.15–1.50	1.15–1.50	1.05–1.25	1.05–1.25
Oriskany Falls and Munnsville, N. Y.	.50–1.00			1.00–1.35		
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
Hillsville, Penn.	.85	1.35	1.35	1.35	1.35	1.35
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill.	1.75		1.75			
Afton, Mich.	.25	.25	.25		.65	1.50
Cypress, Ill.		1.00	1.00	.90	.90	.90
Dubuque, Iowa	1.10	1.10	1.10	1.10	1.10	
Stolle and Falling Springs, Ill.	1.05–1.70	.95–1.70	1.15–1.70	1.05–1.70	1.05–1.70	
Greencastle, Ind.	1.25	1.00	1.00	.90	.90	.90
Lannon, Wis.	.80	.80	.80	.80	.80	.80
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	
Stone City, Iowa	.75		1.10	1.00	1.00	1.00f
Toledo, Ohio (a)	1.10	1.60	1.60	1.60	1.60	1.60
Toronto, Canada (j)	2.10	2.10	2.00	2.00	2.00	2.00
Waukesha, Wis.		.90	.90	.90	.90	
SOUTHERN:						
Cartersville, Ga.	.75	1.15	1.15	1.00	.90	.90
Chico, Tex.	.50	1.30	1.30	1.25	1.20	1.00
El Paso, Tex. (k)	.50	1.25	1.25	1.00	1.00	1.00
Olive Hill, Ky.	.50	1.00	1.00	.90	.90	.90
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.70
Blue Springs and Wymore, Neb. (h)	.25	.25	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	.90	1.25	1.25	1.25	1.00	
Rock Hill, St. Louis Co., Mo.	1.30–1.40	1.30–1.40	1.10–1.40	1.30–1.40	1.30–1.40	1.30–1.40

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn.	1.20	1.60	1.45	1.35		1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	
Bridgeport, Chico and Knippa, Texas..	2.25–2.50	1.80–2.00	1.50–1.60	1.30–1.40	1.20–1.30	1.00–1.25
Duluth, Minn.	1.00	2.25	1.75	1.65	1.35	1.25
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Farmington, Conn.	1.00	1.30	1.30	1.00		
New Britain, Plainville, Rocky Hill, Middlefield, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	
Richmond, Calif.	.75	1.00	1.00	1.00	1.00	
Toronto, Canada (j)	4.70	5.80	4.05			
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Cayce, S. C.—Granite	.50		1.60	1.60	1.40	
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40l
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.—Granite	.50	1.25	1.25	1.15	1.15	
Lohrville, Wis.—Granite	1.80	1.60		1.50	1.50	
Middlebrook, Mo.—Granite	3.00–3.50		2.00–2.25	2.00–2.25		1.25–3.00
San Gabriel and San Fernando Valleys, Calif. (Granite)		1.30	1.30	1.30		1.30
(Basalt)				.85		
Toccoa, Ga.—Granite	.50		1.25	1.30	1.20	1.20

(a) Screenings, including dust. (c) 1-in., 1.40. (d) 2-in., 1.30. (f) Rip rap. (g) Cu. yd. (h) Rip rap, 1.20–1.40 per ton. (j) Extra charge of 10c per ton for winter delivery; all prices less 5% for payment 15th following month. (k) Roofing gravel, per ton, 1.25. (l) Ballast.

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Bethlehem, Penn.	1.25–1.50	.50– .60	1.00	.60– .70	.70– .80	.70– .90	.90
Buffalo, N. Y., Erie and Du Bois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Hokendauqua, Penn.	1.50	.60	1.00	.80–1.00	1.00–1.25	1.00–1.25	1.00–1.25
Western Pennsylvania	2.00	1.25	1.25	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.80*	1.45*	1.45*	1.45*	
Jackson, Ohio	2.05*	.65*	1.80*	1.30*	1.05*	1.30*	
Toledo, Ohio	1.10	1.00‡	1.10	1.10	1.10	1.10	1.10
SOUTHERN:							
Ashland, Ky.	2.05*	1.05*	1.80*	1.45*	1.45*	1.45*	
Ensley & Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.80
Longdale, Va.	2.50	1.25	1.25	1.25	1.25	1.15	1.05
Woodward, Ala.†	2.05*	.55*		1.15*	.90*	.90*	

5c per ton discount on terms. †1½-in. to ¼-in., 1.05; ⅝-in. to 10 mesh, 1.25*; ⅝-in. to 0-in., 90c*; ¼-in. to 10 mesh, .80*. ‡Including dust.

Agricultural Limestone (Pulverized)

Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 50% thru 50 mesh 1.50
Cartersville, Ga. 2.00
Cypress, Ill. 1.25
Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, per ton 6.00
Gibsonburg, Ohio—Analysis, 55% $CaCO_3$; 43.40% $MgCO_3$; bulk, 3.00; in bags.... 4.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$, 90% thru 100 mesh; in bags 1.10–4.00
Jamesville, N. Y.—Bulk, 3.80; in 80-lb. bags 5.05
Joliet, Ill. 3.50
Knoxville, Tenn.—Analysis, 52% $CaCO_3$; 36% $MgCO_3$; 80% thru 100 mesh, in 100-lb. paper bags, 3.75; bulk..... 2.50
Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton..... 2.00
Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh..... 4.25
West Rutland, Vt. — Analysis, 96.5% $CaCO_3$; 1% $MgCO_3$; 90% thru 50 mesh; bags, per ton, 4.25; bulk..... 2.50

Agricultural Limestone (Crushed)

Alton, Ill.—Analysis, 99% $CaCO_3$; 0.3% $MgCO_3$, 90% thru 100 mesh..... 4.00
Bedford, Ind.—Analysis, 98.44% $CaCO_3$; 0.83% $MgCO_3$; 90% thru 10 mesh..... 1.50
Cartersville, Ga.—50% thru 50 mesh, per ton 1.25
Chico, Tex.—¼-in. or ⅛-in. down, per ton 1.00
Colton, Calif.—Analysis, 95-97% $CaCO_3$; 1.31% $MgCO_3$, all thru 14 mesh down to powder 3.50
Cypress, Ill.—90% thru 100 mesh, 1.10; 50% thru 100 mesh, 1.10; 90% thru 50 mesh, 1.00; 50% thru 50 mesh, .90; 90% thru 4 mesh, .90, and 50% thru 4 mesh ..... .90
Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 4 mesh, 50% thru 20 mesh; bulk, per ton 1.00
Dubuque, Ia.—Analysis, 64.20% $CaCO_3$; 32.64% $MgCO_3$; 90% thru 50 mesh.... 1.10
Fort Spring, W. Va.—Analysis, 90% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh; bulk, per ton..... 1.50
Gibsonburg, Ohio—Analysis, 55% $CaCO_3$; 43.40% $MgCO_3$; 50% thru 50 mesh.... 1.25
Lannon, Wis. — Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh..... 2.00
Screenings (¼-in. to dust)..... 1.00
Marblehead, Ohio—90% thru 100 mesh.... 3.00
90% thru 50 mesh..... 2.00
90% thru 4 mesh..... 1.00
Marlbrook, Va.—Precipitated lime-marl. Analysis, 96% $CaCO_3$; 1% $MgCO_3$, 90% thru 50 mesh, bulk, 2.25; in burlap bags 3.75
Olive Hill, Ky.—90% thru 4 mesh, per ton 50–1.00
Branchton, Penn.—100% thru 20 mesh, 60% thru 100 mesh, and 45% thru 200 mesh, per ton..... a5.00
Piqua, Ohio—30%, 50% and 99% thru 100 mesh 1.00–4.00
Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh..... 1.15–1.70
Stone City, Ia.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh..... .75
West Stockbridge, Mass.* — Analysis, 95% $CaCO_3$; 90% thru 50 mesh, bulk 3.50
100-lb. paper bags, 4.75; 100-lb., cloth.. 5.25
Waukesha, Wis.—90% thru 100 mesh, 4.00; 50% thru 100 mesh..... 2.10

*Less 25c cash 15 days. (a) Less 50c comm.

Pulverized Limestone for Coal Operators

Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton.. 6.00
Joliet, Ill.—Analysis, 48% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh (bags extra) 3.50
Piqua, Ohio—99% thru 100 mesh, bulk, 3.25; in 80-lb. or 100-lb. bags..... 4.25
Rocky Point, Va.—Analysis, 97% $CaCO_3$; 75% $MgCO_3$; 85% thru 200 mesh, bulk 2.25–3.50
Waukesha, Wis.—90% thru 100 mesh, bulk 4.00

Lime Products

(Carload prices per ton f.o.b. shipping point unless otherwise noted)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Bulk	Ground burnt lime, Bags	Lump lime In bulk	Lump lime In bbl.
EASTERN:								
Berkeley, R. I.	.....	.....	11.40	.....	.....	17.50	.....	20.65
Buffalo, N. Y.	.....	.....	.....	11.00	.....	.....	.....	.....
Cedar Hollow, Devault, Mill Lane, Knickerbocker, Rambo and Swedeland, Penn.	.....	9.50a	9.50a	9.50a	8.00f	9.50d	8.50	.....
Frederick, Md.	.....	8.50	8.50	8.50	.....	8.50	6.50	13.50
Lime Ridge, Penn.	.....	.....	8.50	.....	6.00	7.50[2]	4.50	.....
West Stockbridge, Mass.	.....	8.25– 8.75	8.25– 8.75	.....	.....	13.50h	10.00	15.35
CENTRAL:								
Afton, Mich.	.....	.....	.....	.....	.....	10.85	6.50	.....
Cold Springs, Ohio	.....	6.00	6.00	.....	.....	.....	6.00	.....
Gibsonburg, Ohio	7.75	.....	6.00	.....	6.00	8.00	6.00	.....
Huntington, Ind.	.....	6.00	.....	.....	6.00	.....	.....	.....
Marblehead, Ohio	.....	6.00	6.00	11.00	.....	.....	6.00	.....
Milltown, Ind.	.....	9.00	8.25	9.50	7.50	.....	7.00	.....
Scioto, Ohio	7.75	6.00	6.00	7.00	.....	.....	6.00	.....
Sheboygan, Wis.	.....	10.50	10.50	.....	.....	.....	9.50	20.00e
White Rock, Ohio	7.75	.....	6.00	.....	6.00	8.00	6.00	.....
Woodville, Ohio	7.75	6.00	6.00	9.00	6.00	8.00	6.00	15.00c
SOUTHERN:								
Keystone, Ala.	15.00	8.00	.....	7.50–10.00	.....	.....	6.00	13.75
Knoxville, Tenn.	.....	6.00– 7.00	6.00– 7.00	6.00– 7.00	.....	.....	4.50j	.....
Pine Hill, Ky.	.....	9.00	8.00	7.50– 9.00	.....	.....	6.00	12.50
WESTERN:								
Little Rock, Ark.	.....	14.30	.....	14.30	.....	.....	11.90	17.40
Kirtland, N. M.	.....	.....	.....	.....	.....	.....	15.00	.....
Los Angeles, Calif.	15.50	14.50	.....	.....	.....	.....	16.00	.....
San Francisco, Calif.†	20.00	20.00	12.00	20.00	.....	.....	.....	.....
San Francisco, Calif.	19.00	14.00–17.00	12.50	14.00–19.00	14.50[5]	.....	11.00[4]	.....

[1]In 100-lb. bags. [4]To 14.50. [5]Also 13.00. *Price to dealers. †Wood-burnt lime: finishing hydrate, 20.00 per ton; pulv. lime, 2.00 per iron drum. Oil-burnt pulv. lime, 13.00–14.50 per ton. (a) In 50-lb. paper. (c) In steel; in wood, 14.00. (d) In 80-lb. paper bags. (e) In steel. (f) For chemical purposes. (h) To 17.50. (j) To 5.50.

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 200-mesh, 6.50 per ton in paper bags

Slate Granules

Esmont, Va.—Blue, 7.50 per ton. Granville, N. Y.—Red, green and black, 7.50 per ton.
Pen Argyl, Penn.—Blue-black, 6.00 per ton in bulk.

Roofing Slate

City or shipping point	Prices per square—Standard thickness 3/16-in.	¼-in.	3/8-in.	½-in.	¾-in.	1-in.
Bangor, Penn.—						
Gen. Bangor No. 1 clear	10.00–14.00	20.00	25.00	29.00	40.00	50.00
Gen. Bangor No. 1 ribbon	9.00–10.25	16.00	20.00	25.00	35.00	46.00
No. 1 Albion	7.25–10.50	16.00	23.00	27.00	37.00	46.00
Gen. Bangor No. 2 ribbon	6.75– 7.25	.....	.....	.....	.....	.....
Granville, N. Y.—						
Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green & gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple & unfading gr'n	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Pen Argyl, Penn.						
Graduated slate	.....	16.00	23.00	27.00	37.00	46.00
No. 1 clear (smooth text)	7.25–10.50; Albion-Bangor medium, 8.00–9.00; No. 1 ribbon, 8.00–8.50					

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:
- Crude talc, per ton 5.00
- Ground talc (20-50 mesh), bags 6.50
- Ground talc (150-200 mesh), bags 9.00
- Pencils and steel crayons, gross 1.50– 2.00

Chester, Vt.—Finely ground talc (carloads), Grade A—99-99¾% thru 200 mesh, 8.00–8.50; Grade B, 97-98% thru 200 mesh 7.00– 7.50
1.00 per ton extra for 50-lb. paper bags; 166⅔-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of burlap bags. Terms 1%, 10 days.

Clifton, Va.:
- Ground talc (150-200 mesh), in bags 10.00

Emeryville, N. Y.:
- Ground talc (200 mesh), bags 13.75
- Ground talc (325 mesh), bags 14.75

Hailesboro, N. Y.:
- Ground talc (300-350 mesh), in 200-lb. bags 15.50–20.00

Henry, Va.:
- Crude (mine run), bulk 3.50– 4.00
- Ground talc (150-200 mesh), in bags .. 6.00– 9.25

Joliet, Ill.:
Ground talc (200 mesh), in bags:
- California talc 30.00
- Southern talc 20.00
- Illinois talc 10.00

Los Angeles, Calif.:
- Ground talc (150-200 mesh), in bags .. 15.00–25.00

Natural Bridge, N. Y.:
- Ground talc (325 mesh), bags 10.00–15.00

Rock Phosphate

Prices given are per ton (2240 lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70% 3.50– 4.00
Mt. Pleasant, Tenn.—B.P.L. 72-77% 5.00– 6.75

Ground Rock
(2000 lb.)

Gordonsburg, Tenn.—B.P.L. 65-70% 3.50– 4.00
Mt. Pleasant, Tenn.—(Lime phosphate) —B.P.L. 73%; per ton, bags extra 11.80
Mt. Pleasant, Tenn.—B.P.L. 72% 5.00– 5.25

Florida Phosphate

(Raw Land Pebble)

Mulberry, Fla.—Gross ton, f.o.b. mines
- 68/66% B.P.L. 3.15
- 70% minimum B.P.L. 3.75
- 72% minimum B.P.L. 4.25
- 75/74% B.P.L. 5.25
- 77/76% B.P.L. 6.25

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Rumney Depot, Bristol and Cardigan, N. H.—Per ton:
- Punch mica, per ton 150.00–240.00
- Mine scrap 22.50
- Mine run 325.00
- Clean shop, scrap 25.00
- Roofing mica 37.50
- Trimmed mica, per ton, 20 mesh, 37.50; 40 mesh, 40.00; 60 mesh, 40.00; 100 mesh, 45.00; 200 mesh 60.00

Spruce Pine, N. C.—Mine scrap, per ton 18.00– 20.00

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

City or shipping point	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¼x32x 36". Per M Sq. Ft.	⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
East St. Louis, Ill.—Special Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton; floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 6 in. long, 17c per ft., 23.00 per ton.													
Grand Rapids, Mich.	.....	.....	.....	9.00	9.00	9.00	.....	.....	.....	.....	15.00	15.00	27.00
Los Angeles, Calif. (a)	.....	7.50	7.50	12.20	12.20	.....	13.20	.....	29.00	.....	.....	.....	.....
Medicine Lodge, Kan.	1.40	.....	.....	.....	.....	.....	11.50b	.....	16.00b	.....	.....	.....	.....
San Francisco, Calif.	.....	.....	.....	.....	14.90b	.....	.....	.....	.....	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	———	.....	.....	.....	20.00	25.00e	33.00d

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) ⅜-in. plaster lath, 16c per sq. yd. (b) Includes paper bags. (c) Includes jute sacks. (d) "Gyproc," ½-in.x48-in. by 5 and 10 ft. long. (e) ½x48-in. by 3 to 4 ft. long.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink	¶12.50–‖14.50	¶12.50–‖14.50
Cranberry Creek, N. Y.—Bio-Spar, per ton in bags in carload lots, 9.00; less than carload lots, per ton in bags		12.00
Crown Point, N. Y.—Mica Spar		¶9.00–‖12.00
Davenport, Iowa — White limestone, in bags, ton	‖6.00	‖6.00
Middlebrook, Mo.—Red		20.00–25.00
Middlebury, Vt.—White		¶9.00–‖10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		c5.50
Phillipsburg, N. J.—Royal green granite, in bags	15.00–18.00	
Randville, Mich. — Crystalite crushed white marble, bulk	4.00	4.00– 7.00
Tuckahoe, N. Y.	7.00	
Warren, N. H. (d)		¶8.00– 8.50

¶C.L. ‖L.C.L. (a) Including bags. (b) In burlap bags, 2.00 per ton extra. *Per 100 lb. (c) Per ton f.o.b. quarry in carloads; 7.00 per ton L.C.L. (d) L.C.L., 9.50–15.00 per ton in 100-lb. bags.

Granular Glasspar

(Chemically Controlled)

Spruce Pine, N. C.—Color, white; analysis, K_2O, 7.20%; Na_2O, 3.70%; SiO_2, 70%; Fe_2O_3, 0.05%; Al_2O_3, 17.50%; per ton, in bulk — 10.50

Soda Feldspar

De Kalb Jct., N. Y.—Color, white; pulverized (bags extra, burlap 2.00 per ton, paper 1.20 per ton); 99% thru 140 mesh, 16.00; 99% thru 200 mesh — 18.00

Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 5.50%; Na_2O, 5.50%; SiO_2, 68.80%; Fe_2O_3, 0.10%; Al_2O_3, 18.60%; per ton, in bulk — 18.00

Potash Feldspar

East Liverpool, Ohio — Color, white; analysis, K_2O, 11.00%; Na_2O, 2.25%; SiO_2, 68.00%; Fe_2O_3, .08%; Al_2O_3, 17.95%, pulverized, 99% thru 200 mesh, in bags, 22.00; in bulk — 20.00

Erwin, Tenn.—White; analysis, K_2O, 10.50%; Na_2O, 2.75%; SiO_2, 67.75%; Fe_2O_3, .08%; Al_2O_3, 18.00%, pulverized, 98% thru 200 mesh, in bags, 16.00; bulk — 15.00
Crude, in bags, 7.50; bulk — 6.50

Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 11.30%; Na_2O, 2%; SiO_2, 67%; Fe_2O_3, 0.10%; Al_2O_3, 18.60%; per ton, in bulk — 18.00

Trenton, N. J.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 69%; Fe_2O_3, 0.08%; Al_2O_3, 17%; pulverized, 98% thru 200 mesh; bulk, 20.00; in bags — 21.20

West Paris, Me.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 11.20%; Na_2O, 3.20%; SiO_2, 65.70%; Fe_2O_3, 0.09%; Al_2O_3, 19.20%; per ton, in bulk — 19.00

Rochester, N. Y.—Color, white; analysis, K_2O, 12.50%; Na_2O, 2.60%; SiO_2, 64.20%; Fe_2O_3, 0.06%; Al_2O_3, 19.10% pulverized 98% thru 200 mesh; in bags, 23.50; bulk — 22.00

Cement Drain Tile

Grand Rapids, Mich.—Drain tile, per 1000 ft.

4-in.	40.00	15-in.	325.00
5-in.	50.00	18-in.	450.00
6-in.	75.00	20-in.	600.00
8-in.	110.00	22-in.	750.00
10-in.	165.00	24-in.	850.00
12-in.	190.00		

Chicken Grits

Cypress, Ill.—(Agstone), per 100-lb. sack	.90
Chico, Tex.—Hen size and Baby Chick, packed in 100-lb. sacks, per 100-lb. sack, f.o.b. Chico	1.00
Davenport, Iowa—High calcium carbonate limestone, in bags, L.C.L., per ton	6.00
El Paso, Tex.—(Limestone), per 100-lb. sack	.75
Gibsonburg, Ohio—(Agstone)	10.00
Joliet, Ill.—(Agstone)	10.00
Los Angeles, Calif.—(Gypsum), per ton, including sacks	7.50– 9.50
Middlebury, Vt.—Per ton (a)	10.00
Piqua, Ohio—(Pearl grit), No. 1 and No. 2	1.00– 4.00
Port Clinton, Ohio—(Gypsum), per ton	6.00
Randville, Mich.—(Marble), per ton, bulk	6.00
Warren, N. H.	8.50– 9.50
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.	¶7.50–‖9.00

(a) F.o.b. Middlebury, Vt. ¶C.L. ‖L.C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis. (f.o.b.) Barton	9.50
Dayton, Ohio	11.50
Detroit, Mich.	‡13.00–15.50b
Flint, Mich.	15.50‡
Grand Rapids, Mich.	14.00
Iona, N. J.	10.50–12.00
Jackson, Mich.	13.00
Madison, Wis.	12.50†
Milwaukee, Wis.	12.50*
Minneapolis and St. Paul, Minn.	9.50*
Mishawaka, Ind.	11.00
New Brighton, Minn.	10.00
Pontiac, Mich.	13.00
Saginaw, Mich.	13.50
Sebewaing, Mich. (at yard)	12.50
Syracuse, N. Y.	18.00–20.00
Toronto, Canada	a10.00–‡13.00*
Wilkinson, Fla.—White, 10.00; buff	14.00
Winnipeg, Canada	15.00

*Delivered on job. †Less 50c dis. per M 10th of month. ‡5% disc., 10 days. §Delivered in city. (a) Also 12.00. (b) Truck delivery.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

City or shipping point	
Beloit, Wis.:	
8x8x16	16.00*
Brookville, Penn.: 8x8x16	20.00–23.00*
Camden, N. J.: 8x8x16, each	.18
Chicago, Ill.:	
8x8x16. Each	.17§
8x8x16. Each	.20a
Columbus, Ohio: 8x8x16	14.00§–16.00‡
Graettinger, Iowa	.18– .20
Indianapolis, Ind.	.10– .12‡
Lexington, Ky.:	
8x8x16	‡18.00*
8x8x16	†16.00*
Los Angeles, Calif.:	
4x8x12	4.50*
4x6x12	3.90*
4x4x12	2.90*
Omaha, Neb.:	
8x 4x16, each .06½§; 8x6x16, each	.09§
8x 8x16, each .10§; 8x8x16, each	.12‡
8x12x16, each	.15§
Oak Park, Ill.:	
8x8x16, per 1000	160.00
Pittsburgh, Penn. (Prices at yard)	
8x 8x16. Each	.17§
8x 8x16. Each	.19a
8x12x16. Each	.20§
8x12x16. Each	.22a
Wichita, Kan.:	
8x8x16. Each	.11§

*Price per 100 at plant.
†Rock or panel face.
‡Face. §Plain. (a) Rock face.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Cicero, Ill.—French, Spanish, Closed End Shingle, and English Shingle, per sq.	9.50–13.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Lexington, Ky.—8x15, per sq.: Red	15.00
Green	18.00
Longview, Wash.: 4x6x12-in., per 1000	55.00
4x8x12-in., per 1000	65.00
New Castle, Penn.—Red, 9x15-in.	12.00
Green, 9x15-in.	15.00
New York City, N. Y.:	
Roofing tile, red, 10.00; green	12.00

Cement Building Tile

Oak Park, Ill. (Haydite):	
8x 8x16, per 100	20.00
Lexington, Ky.:	
5x8x12, per 1000	55.00
4x5x12, per 1000	35.00
Longview, Wash. (Stone Tile):	
4x6x12, per 1000, at plant	54.00
4x8x12, per 1000, at plant	64.00

Wichita, Kan.: (Duntile)

	Plain	Glazed
8x8x12. Each	.10½	.14
6x8x12. Each	.09½	.13
4x5x12. Each	.05	.08
4x4x12. Each	.04½	.07½

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Beloit, Wis.	20.00	
Camden & Trenton, N. J.	17.00	
Oak Park, Ill., "Haydite"	16.00	
Ensley, Ala., "Slagtex"	*10.00–13.00†	
Longview, Wash.	16.50	22.00– 40.00
Milwaukee, Wis.	13.00	20.00– 36.00
Omaha, Neb.	18.00	30.00– 40.00
Prairie du Chien, Wis.	14.00	22.00– 25.00
Rapid City, S. D.	16.00	30.00

*Price f.o.b. plant. †Delivered on job in city.

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points. Bags extra and returnable for full credit.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00
Joliet, Ill.—All passing 100 mesh, f.o.b. Joliet, including cost of bags	24.00

Stone-Tile Hollow Brick

Prices are net per thousand, f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Asheville, N. C.	35.00	50.00	60.00
Atlanta, Ga.	29.00	42.50	53.00
Brownsville, Tex.		53.00	62.50
Brunswick, Me.†	40.00	60.00	80.00
Charlotte, N. C.	35.00	45.00	60.00
De Land, Fla.	30.00	50.00	60.00
Farmingdale, N. Y.	37.50	50.00	60.00
Houston, Tex.	35.00	45.00	60.00
Jackson, Miss.	45.00	55.00	65.00
Klamath Falls, Ore.	65.00	75.00	85.00
Longview, Wash.		55.00	64.00
Los Angeles, Calif.	29.00	39.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	50.00	55.00	65.00
Mineola, N. Y.	45.00	50.00	60.00
Nashville, Tenn.	30.00	49.00	57.00
New Orleans La.	35.00	45.00	60.00
Norfolk Va.	35.00	50.00	65.00
Passaic, N. J.	40.00	52.50	70.00
Patchogue, N. Y.		60.00	70.00
Pawtucket, R. I.	35.00	55.00	75.00
Safford, Ariz.	32.50	48.75	65.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50

Prices are for standard sizes—No. 4, size 3½x 4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% discount.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4-in.	6-in.	8-in.	10-in.	12-in.	15-in.	18-in.	20-in.	22-in.	24-in.	27-in.	30-in.	36-in.	42-in.	48-in.	54-in.	60-in.
Grand Rapids, Mich. (b)																	
Sewer	.....	.12	.18–.20	.27½	.35	.57½	1.00	1.11	1.48	1.66	.....	.....	.....	.....	.....	.....	.....
Culvert	.....	.....	.....	.57	.67	.93	1.20	.....	1.48	1.80	2.10	2.25	3.35	4.00	5.10	5.85	7.42
Indianapolis, Ind. (a)	.....	.....	.....	.75	.85	.90	1.15	.....	.....	1.60	.....	2.50	.....	.....	.....	.....	.....
Mercedes, Texas																	
Tongue and groove	.....	.20	.23	.29	.35	.....	.74	.91	.....	1.38	.....	2.28	.....	.....	.....	.....	.....
Sewer	.16	.22	.32	.41	.53	.78	1.05	.....	.....	1.98	.....	.....	.....	.....	.....	.....	.....
Milwaukee, Wis.						Cast stone window sills, 5 in. x 5½ in., 60c per lineal ft.											
Newark, N. J. (d)	.....	.....	.....	.....	.90	1.15	1.50	.....	.....	1.85	2.35	2.76	3.77	4.93	6.21	7.66	9.28
Unreinforced	.....	.16	.25	.37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Norfolk, Neb.	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Tiskilwa, Ill. (e)	.....	.....	.....	.75	.85	.95	1.20	1.60	.....	2.00	.....	2.75	3.40	.....	6.50	.....	10.00
Wahoo, Neb. (c)	.....	.....	.....	.....	.85½	.....	1.14	.....	.....	1.81	.....	2.47	3.42	4.13	5.63	6.49	7.31

†21-in. diam. (a) 24-in. lengths. (b) Sewer, 21-in., 1.29; culvert, 21-in., 1.45. (c) Reinforced, 15.40 per ton, f.o.b. plant. (d) Reinforced, 21-in., 1.69; unreinforced, 21-in., 1.26; 5% cash discount. (e) Reinforced.

News of All the Industry

New Incorporations

Bluffton Stone Co., Bluffton, Ohio, $50,000.

Matthiessen Gravel Co., Brentwood, N. Y., 200 shares common.

Quality Sand and Gravel Co., Wapakoneta, Ohio, $6,000.

W. H. Baker Sand Co., Benton Harbor, Mich., 250 shares of no par value.

Crystal Sand and Gravel Co., Battle Creek, Mich., $50,000 and 100 shares of no par value.

Ada Silica Co., Millville, N. J., $100,000. To produce cement blocks. Walter H. Bacon, Bridgeton, N. J.

Flint Gravel Co., Muskogee, Okla., $50,000. C. P. Gotwals, John T. Gibson and Millie Hurst, all of Muskogee.

Good Roads Gravel Co., Muskogee, Okla., $100,000. C. P. Gotwals, John T. Gibson and Millie Hurst.

Pioneer Sand and Gravel Co., Muskogee, Okla., $25,000. C. P. Gotwals, John T. Gibson and Millie Hurst.

Garden State Sand and Gravel Co., Inc., Bernardsville, N. J., $50,000. Edward J. Geis, Grace M. Holley and George C. Ellis, Bernardsville.

Morris County Crushed Stone Co., Morristown, N. J., $500,000. Robert H. Schenck, Elmer S. King and Carl G. Vogt, Morristown.

Southern Gravel Co., Baltimore, Md., 20,000 shares of common stock, par value $10 each. Wm. H. Dempsey, Jr., J. Leiper Winslow and Heyward Taylor.

M. J. Lotto Construction Co., Inc., De Pere, Wis., 200 shares at $100 each. To produce gravel and other building materials. M. J. Lotto, F. Lotto and G. Reinert.

Thrower Marble and Tile Co., Inc., Charlotte, N. C., $50,000. To deal in marble, stone and marble products. H. T. Thrower, T. A. Henry and T. C. Henry of Charlotte.

Eastern Quarries, Inc., Boston, Mass., 1000 shares common of no par value. President, Thomas E. Jansen, Jr., 19 Congress St., Boston; Edith S. Fee and Archibald M. Knowles.

Waterbury Mixed Concrete Co., Waterbury, Conn., $12,500. J. Francis Smith, president; Joseph S. Barbara, vice-president; Benjamin Chatfield, treasurer, and Harold W. Brown, secretary.

Blue Rock, Inc., Washington C. H., Ohio, increased capital stock from 300 shares of no par value to 2000 shares. J. W. Barker, president, and C. J. Uible, secretary.

Berdew Slate Co., Poultney, Vt., 50 shares at $100 a share. To produce all kinds of slate products. F. Bertolino, William R. Hughes and Carmen De Bonis.

Peninsular Lime Rock Co., Columbus, Ohio, 300 shares of no par value. Lucille Siefert, W. W. Summer, Chalmers M. Parker, W. M. Summers, 8 E. Broad St., Columbus, Ohio.

Edison Cement Corp., West Orange, N. J., $500,000 preferred stock and 10,000 shares common stock of no par value. Arthur F. Egner, Harvey D. Leuin and Lillian A. Peck, Newark.

Quarries

Michigan Alkali Co., Wyandotte, Mich., has let contract to the Link-Belt Co., Chicago, Ill., for a belt conveyor for handling coal.

Marblehead Lime Co. has resumed operations at its Hannibal, Mo., plant with a force of 30 men. The plant has been shut down for two months.

Clarke County Lime Co., recently organized, has a quarry 2½ miles northwest of Osceola, Ia., and is producing crushed rock and agricultural lime. C. C. Graham is secretary and treasurer.

Fort Scott Hydraulic Cement Co., Fort Scott, Kan., has received a contract from the city commission for 20 cars of rock dust for use of the city street department. The price was $4.70 per ton.

The Pageland Stone Quarry, Columbia, S. C., has agreed to furnish stone for highway-building purposes to the state highway commission at $1.45 per ton.

John T. Wilson is operating a lime rock quarry on his farm near Plymouth, Ill. A switch track has been laid to facilitate removal of the rock, which is said to be of excellent quality.

Chicago and Northwestern Railroad's quarry and stone-crushing plant north of Le Grand, Ia., is being inventoried preparatory to advertising it for sale, according to reports.

Independence, Kan. The board of county commissioners is arranging to open up four or five rock quarries in the county soon. The rock will be used for surfacing county roads.

The Taylor Stone Co., McDermott, Ohio, is to operate the Allegheny stone quarries east of Lancaster, Ohio. Construction of a railroad switch is half completed and a large area of the deposit has already been uncovered preparatory to quarrying.

Gantts Quarry, Ala. The quarry here has resumed full operation. This is one of the largest enterprises in this section, it is reported, and while it has been operating on short time for the past few months, indications are that it will continue at full time indefinitely.

U. S. Marble Co. will soon begin operations on a large scale near the old site of the marble quarry west of Canon City, Colo. It is reported that engineers have made preliminary investigations and have discovered the marble to be unique in structure and color.

Caney, Kan. The county commissioners met in extra sessions to devise a plan to start approximately 75 men to work in rock quarries in this vicinity, to relieve the unemployment situation. Work has already begun at two of the proposed quarries, one near Elk City and one near Coffeyville.

Denver, Colo. It is reported that Mayor Stapleton of Denver will purchase such part of the granite as is necessary to complete the city and county $5,000,000 building from quarries located at Stone Mountain, Ga. While Platte Canyon, which is just a stone's throw from Denver, has granite in abundance, it is of a pinkish hue, while the specifications call for a light gray granite.

Columbia Stone and Quarry Co., Columbia, Mo., has completed improvements at its quarry on Highway 63. A new storage plant containing three partitions has been erected and the company has installed a new 35-hp. engine to run the crusher, a new screen and other equipment. The plant produces several grades of crushed rock and agricultural lime.

Sand and Gravel

Prospect Sand and Stone Co., Eagle, Wis., has filed a voluntary petition for bankruptcy.

Sheridan Sand and Gravel Co., Sheridan, Ill., has contracted with the Link-Belt Co., Chicago, for a sand and gravel washing and screening plant.

Central Sand and Gravel Co., Seattle, Wash., received a tax refund of $2,228 from the treasury department.

Spruce Pine Sand and Gravel Co., Spruce Pine, Ala., was refunded the sum of $650 by the government for over-assessment of taxes paid for the fiscal year ending June 30, 1930.

Deeks Sand and Gravel Co., Vancouver, B. C., has applied to the city for lease of an additional 50 ft. of property at the north end of the 600-ft. block of property near Manitoba street held by the company on lease from the city until 1934.

Standard Sand and Gravel Co., Wheeling, W. Va., has donated sand for the Water street paving project between 39th and 41st streets, Wheeling. It is estimated that from 15 to 30 tons of sand will be required for the project.

The State Gravel Co., Jackson, Miss., has acquired a gravel plant near Crystal Springs, Miss., located on a spur of the Illinois Central. Negotiations are said to be under way for additional deposits near by.

Kaiser Paving Co. has asked the permission of the Board of Public Works to construct a gravel plant at the northeast corner of 18th and Carolina streets, San Francisco, Calif. Estimated cost of the project is $11,000.

The Fillmore Rock Co., Fillmore, Calif., entertained the rock and gravel men of the county recently at a dinner at the Pierpont Inn in Ventura, Calif. Those present were: Mr. Stovall, general manager of the Saticoy Rock Co., Messrs. Smith and Barker of the Santa Clara Rock Co., Mr. Don Woolsey of the El Rio company, Mr. Clark of the Consolidated Rock Products Co., and Messrs. Jourdan and Bishop of the Fillmore company.

Cement

La Tolteca cia de Cemento Portland, S. A., Mexico City, Mexico, is installing Northern Blower dust collecting equipment in its new plant.

Medusa Portland Cement Co., Cleveland, Ohio, is planning expansion of its production facilities at its Silica, Ohio, plant.

Marquette Cement Manufacturing Co., Cape Girardeau, Mo. A complete dust collecting system for the coal house of the company is being installed by the Northern Blower Co.

Pacific Coast Cement Co.'s employes turned over a cement sack containing $400 for the fund for neediest families for which the Seattle Times is conducting a campaign at this time.

Universal Atlas Cement Co. will resume operations at its plant at Independence, Kan., on January 19, after a temporary suspension of production.

Southwestern Portland Cement Co., Victorville, Calif. Calcite cement rock to the extent of 100,000 tons was loosened by a huge blast at the quarries of the company recently. The blast was made under the supervision of Engineer A. E. Deegan of the Giant Powder Co.

Ideal Cement Co., Denver, Colo., has another gas well near its Ada, Okla., mill, the latest well making the company's supply 25,000,000 cu. ft. of gas daily. The gas will be piped and used in the Ada plant. According to reports, if given full sway, the Ideal has enough gas wells to supply 100,000,000 cu. ft. of gas daily, but it is obeying the conservation ruling of state oil-gas officials.

Cumberland Portland Cement Co., Cowan, Tenn., held its annual banquet for employes of the company at the Franklin Hotel in Cowan on December 19, covers being laid for 60 guests. An address of welcome was extended by Mayor George M. Thorogood. Other interesting speeches of the evening were made by Walter S. Ernst, chief chemist for the cement company; J. Foster Cook, sales manager of the company; H. Frank Hughes, traffic manager, and an address on safety by L. B. Reifsneider, quarry superintendent and safety director. Frank Pearson, secretary and treasurer, acted as toastmaster. A novel feature of the entertainment was a demonstration of safety and first-aid training put on by the First-Aid team of the Cumberland plant organization. Luther Williams is captain of the team.

Gypsum

Standard Gypsum Co., Long Beach, Calif., is planning expansion and improvements at its plant, including additional units and installation of equipment to cost over $90,000. Festus T. McDonough is manager.

Silica Sand

The Silica Sand Co., near Caryville, Tenn., has spent more than $30,000 for new equipment. This company, which has been in operation for two years, supplies silica sand to the large marble mills in and near Knoxville.

Pennsylvania Glass Sand Corp., Lewistown, Penn., is installing a dust collector at its Berkeley Springs plant and is making additions to its dust collecting equipment at the Hancock and Mapleton Depot plants.

Cement Products

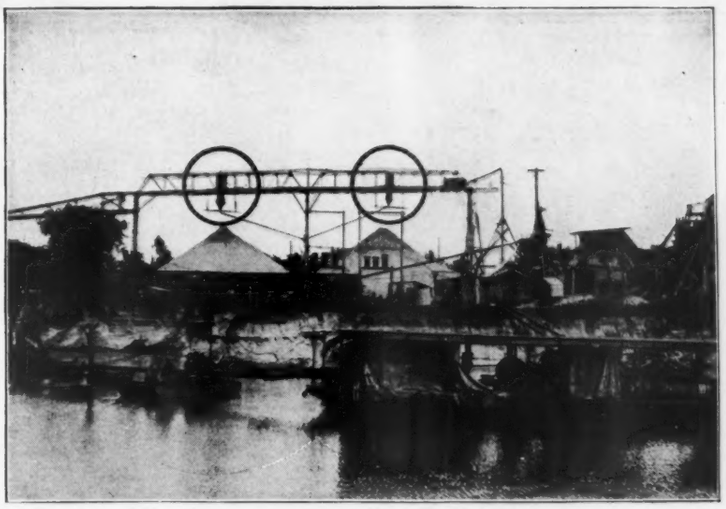
Media Concrete Products Co., Media, Penn., is planning the rebuilding of that portion of its plant recently destroyed by fire, with a loss of over $50,000, including equipment.

Agricultural Limestone

The Chemical Lime Co., Bellefonte, Penn., has started work on the erection of two large concrete and steel bunkers for the storage of agricultural lime. Each bunker will be 80 ft. high and 30 ft. in diameter. They will have a capacity of over 5000 barrels and will enable the company to manufacture agricultural lime during the winter and store it against the large demand in the spring.

Slate

Brownsville Slate Co., Brownsville, Maine, is planning a one-story addition and improvements to its present plant, to cost over $40,000 with equipment. L. H. Alline, Presque Isle, Maine, is in charge.



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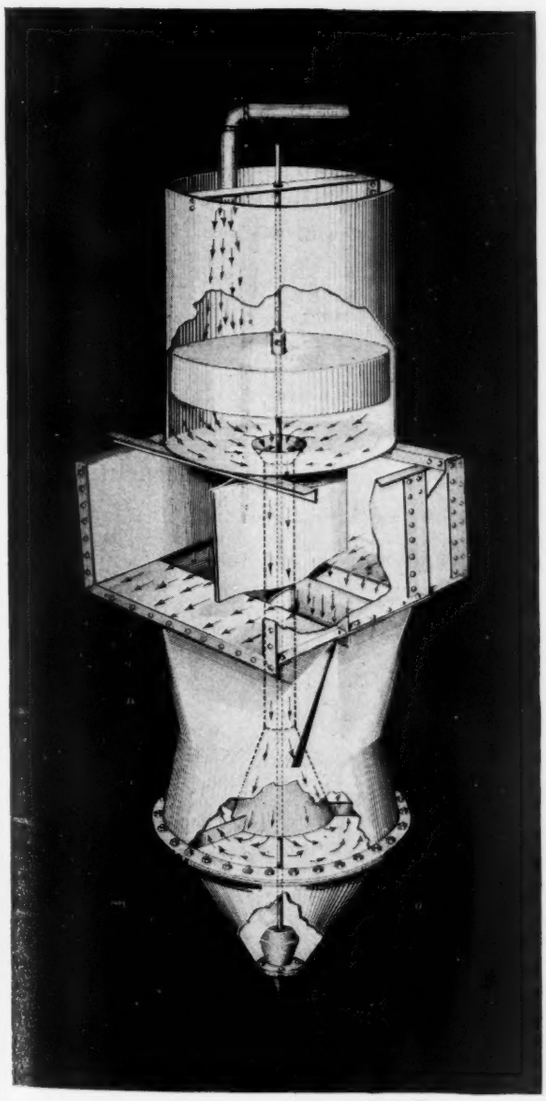

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